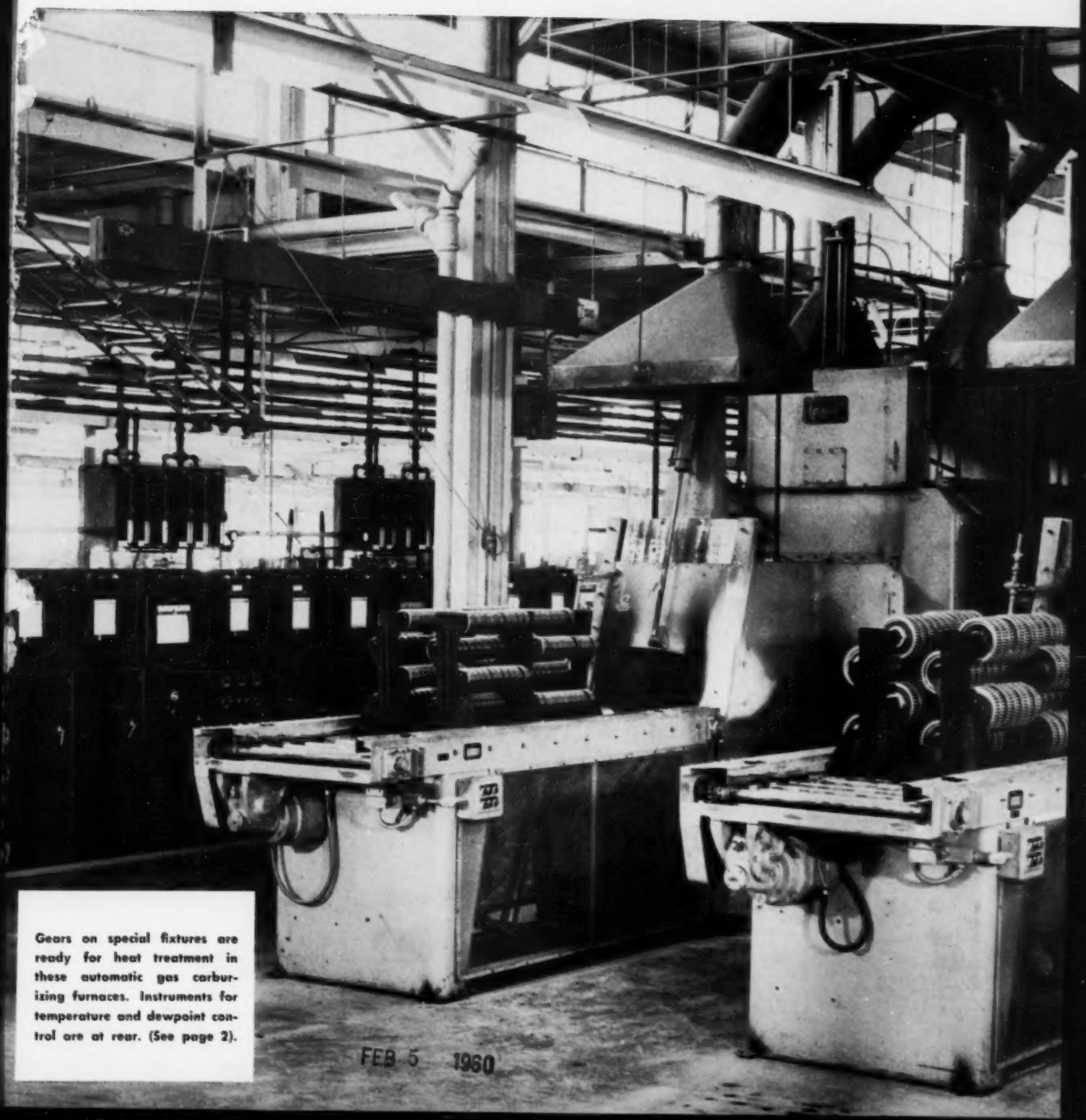
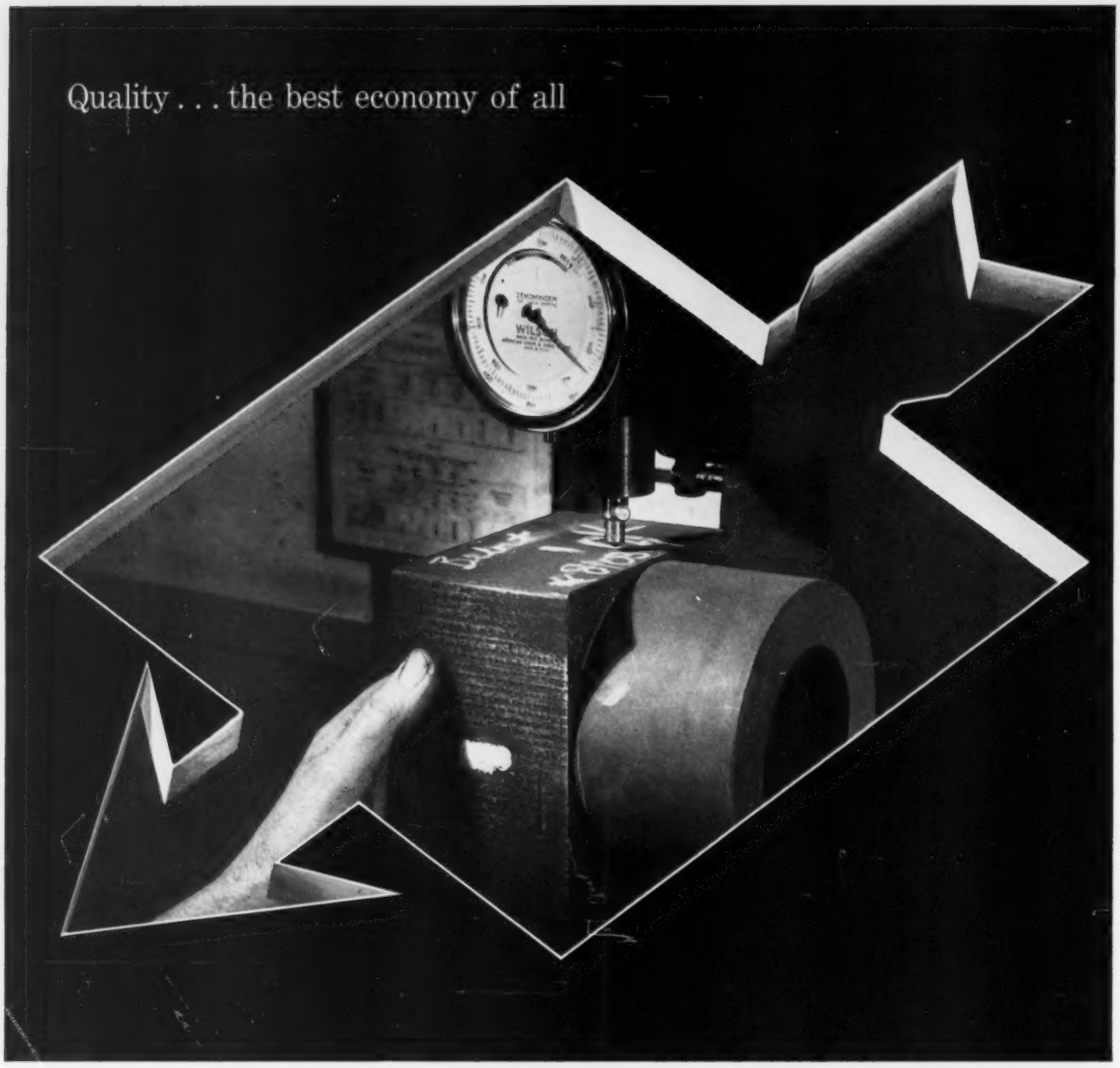
MAY
JUNE 1959

Metal Treating

THE ONLY MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY



Gears on special fixtures are ready for heat treatment in these automatic gas carburizing furnaces. Instruments for temperature and dewpoint control are at rear. (See page 2).



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Metal Treating

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Vol. X
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BPA

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MODERN AUTOMATIC GAS CARBURIZING OF TRANSMISSION PARTS

By **GEORGE M. TRAVERS,** Chief Metallurgist
Fuller Manufacturing Company
Kalamazoo, Michigan

FOR MANY YEARS, Fuller Manufacturing Company of Kalamazoo, Michigan, has developed and supplied heavy duty transmissions to truck and tractor manufacturers. Most of the components for these transmissions are manufactured and heat treated in Fuller's own plants.

Recently, the widespread acceptance of the company's "RoadRanger" semi-automatic transmissions, taxed production and heat treat capacity. New plant facilities were built and modern equipment installed.

The contemplated furnaces had to be adaptable to either long or short-cycle carburizing and carbonitriding; capable of either normal oil quenching or heated oil marquenching, and as automatic in operation as possible. Further requirements included use of flat conveying trays adapted to existing fixture and support bar designs; equipment-arrangement to facilitate maintenance of conveyor and heating element parts; and the most modern instrumentation for control of temperature as well as atmosphere.

Finally, it was felt that multiples of a medium production furnace, rather than one large unit, would be desirable. These features were all met in automatic two-zone furnaces supplied by Ipsen Industries, Inc.

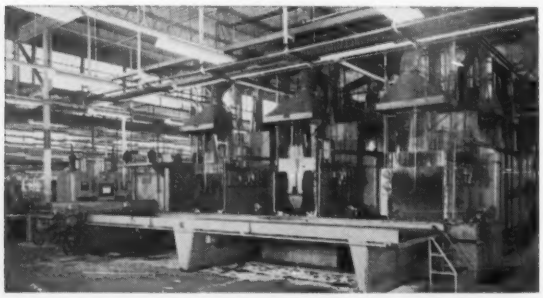

Fig. 1—Discharge end of three-furnace group, with mutual cross transfer loader-unloader. Washing machine and endothermic generator equipment to left, rear.

The complete equipment is installed in an area embracing a centrally-located rectangular loading area, serving six carburizing furnaces, and two tempering furnaces. Each of two groups of three hardening furnaces is served at the outer, or discharge end by an unloading mechanism carried upon a cross transfer car. Trays of finished heat treated material are received by this conveyor, automatically moved to a fourth line of equipment, automatically expelled from carrier into a washing machine for the removal of residual quench oil, and progressively moved through a tempering furnace. Finally, discharged adjacent to the central loading area, material is cooled to handling temperature; trays are cleared, reloaded, and moved on floor dollies to a predetermined furnace charging position.

Special gas atmosphere generators are disposed to each side of the two groups of furnaces, along with upright cabinets containing temperature control instrumentation, cyclic step time controls, and dewpoint recording and controlling equipment.

Each carburizing furnace consists essentially of a mechanized stationary loading mechanism, two hot zones separated by an intermediate door and terminated at each end in well insulated outer doors; an oil quenching mechanism of the elevator immersion type, contained in an insulated tank, and completely covered by a water jacketed hood to permit quenching from the protective atmosphere; and a plate type discharge door through which a tray of finished material may be withdrawn to the automatic cross transfer.

Designed with easily replaceable alloyed ceramic radiant heating tubes, the distance between adjacent furnaces is held to a minimum. The individual zones

in each furnace are provided with refractory directional flow baffles and high velocity motor driven fan equipment to promote fast, uniform heating at temperatures up to 1850° F.

The tempering furnace serving each group of three carburizing furnaces, is of the double-ended tunnel type, direct gas-fired with provision for uniform convection heating by means of bottom-mounted centrifugal fans, and of sufficient size to accommodate four of the standard trays utilized in the carburizing furnaces.

These furnace trays are of heavy cast nickel-chromium alloy skeleton type, measuring approximately 28" wide by 45" long and weighing approximately 145 lbs. per tray. Despite rough handling, heavy loading, and daily subjection to high temperatures, low dewpoint carburizing atmospheres, and oil quenching from temperatures as high as 1700° F, the trays ordered with the original furnaces are sound and undeteriorated in any way after more than 12,000 hours of use.

The adaptation of six complete high temperature carburizing furnaces rather than one large furnace for the same approximate production, permits complete versatility and scheduled heat treating, since each individual furnace may be preset for any given circumstances of temperature, cycle time, atmosphere concentration and quench temperature. Alternately, all six furnaces may be operated under identical conditions to produce the rated tonnage of one type of steel carburized to a common case depth, and quench hardened to within very close limits of predictable hardness.

The operating procedure of each of the six carburizing furnaces is substantially the same. A charge of steel parts together with the requisite fixtures and loading bars are assembled upon a furnace tray. After a tray is prepared, it is placed upon the loading extension of the particular furnace to be utilized, and the proper adjustment for temperature and atmosphere control, and heat up and carburizing time checked at the common control panel. Thereafter, the function of the equipment through the carburizing and hardening furnace is completely automatic. At the end of the predetermined time interval, the door between the furnace and quench chamber rises, the fan within the second zone of the heating chamber stops, and the cold-chain type transfer mechanism characteristic to this type of Ipsen furnace is actuated to carry a tray or basket of finished carburized parts completely out of the second zone, beneath the discharge door, and into quenching position upon the elevator rack within the quench enclosure. Thereafter the door automatically closes, the second zone fan starts, and the elevator rack immediately descends to immerse the tray and charge in oil at normal quenching temperature (140°-170° F.), or marquenching oil at a temperature of from 300° to 350° F.

At such time as a tray of finished carburized material is in discharge position upon the elevator rack within the quench enclosure, the operator clears the position of the cross transfer unloader from normal "end" position opposite a fourth line of equipment comprised of a washing machine and a draw furnace. The unloader is positioned opposite to the furnace to be discharged, the quench enclosure door closes, and the cross transfer mechanism carries the tray to normal "end" position, where a reversal of the unloading cycle charges the tray into the return line through washing machine and tempering furnace.

When a tray of material is about to be discharged from the cross transfer mechanism, the doors of the washing machine, and of the tempering furnace rise, and transfer equipment within the furnace actuated

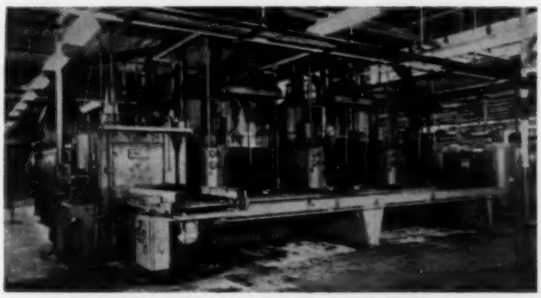

Fig. 2—Discharge end of three-furnace group, with mutual cross transfer loader-unloader. Line of washing machine, tempering furnace, and cooling extension at left. Automatic generator at right, rear.

from the discharge end, advances, secures each of the four trays within the furnace chamber, and moves these towards the discharge end one position, thus removing the first tray in line out onto a discharge extension, and clearing a position to which the transfer loader-unloader mechanism at the charging end of the equipment supplies a tray of finished washed material from the washing machine, while simultaneously placing the most recently oil quenched tray of parts from the loader-unloader, in registration within the washing machine. The loader-unloader mechanism is then completely retracted, the doors of the draw furnace close, and simultaneously the plate type doors at each end of the washing machine close to prevent ricochet from spray jets within the enclosure, directed into and through the charge from all sides, by means of a centrifugal pump. The unloading extension of the draw furnace equipment is provided with forced air draft from beneath to expedite the cooling of parts upon the tray just discharged from the tempering furnace. When parts are cool enough to be removed from the tray, the tray is cleared and transferred to another position to facilitate reloading.

A test pin of similar steel accompanies each load through the carburizing and quenching cycle. Subsequent grinding of a flat on one side of the specimen and checking hardness to 50 Rc permits determination of case depth. In addition, the test pin is sectioned, polished and etched, and examined to confirm previous findings. Each sample is properly identified, recorded and systematically stored for any necessary future reference. Periodically, additional specimens in

(Continued on page 47)

HEAT TREATING DISCUSSIONS AT THE 1959 WESTERN METAL SHOW

By **THOMAS A. DICKINSON**
West Coast Reporter

HEAT TREATING was once again a topic that received major attention at the Eleventh Western Metal Congress and Exposition, Los Angeles, March 16-20. In fact, it was the sole subject of one entire morning technical session staged by the American Society for Metals.

ASM Technical Sessions

Of particular interest during the latter session were remarks made by Norbert M. Koebel, director of research and manager of the furnace division of Lindberg Engineering Co., Chicago, regarding recent advances in the development of instrumentation for the control of carbon in the heat treatment of steel.

"Present-day methods of control are by no means static," Koebel pointed out. "Changes and improvements can be expected in the future due to such variables as furnace designs and sizes, infiltration factors, heating cycles, temperature ranges, carbon potential ranges, and sampling problems."

However, he added that many things already being done—in the aircraft and missile industries, for instance—could not be expected without instrumentation which is now available.

"Cleanliness, or preparation of the steel to be treated, and a certain degree of maintenance," he cautioned "are still required to obtain good results from any carbon control system."

Another speaker who aroused much interest was Thomas R. Bradley, supervisor of metallurgy for Rohr Aircraft Corp., Chula Vista, Calif. He discussed dies and other fixtures for the prevention of warpage in quenching steel, aluminum, and titanium sheet—explaining that, while warpage due to the quenching of heavy sections can be corrected by machining, parts with thin sections should be dimensionally correct in the as-quenched state.

"The use of thin steel at high heat levels," he emphasized, "has made the straightening of some hardened parts practically impossible."

Bradley cited quench rates for different alloys, part dimensions, furnace locations, and costs as items that should receive major attention in the development or selection of special tooling for the elimination of warpage in quenching.

In a panel discussion on the reduction of warpage by creep forming and die quenching nonferrous alloys, senior research engineers J. Soja of North American Aviation, Inc., stated that the close tolerance contour of aluminum and titanium airframe parts can be maintained by hot sizing titanium alloy sheets and the prestress hot forming of aluminum alloy skins.

Time, temperature, deflection, pressure, die modification on final dimensions, and mechanical properties were mentioned by Soja as factors that determine results in die quenching either sheet or machined parts comprising nonferrous metals.

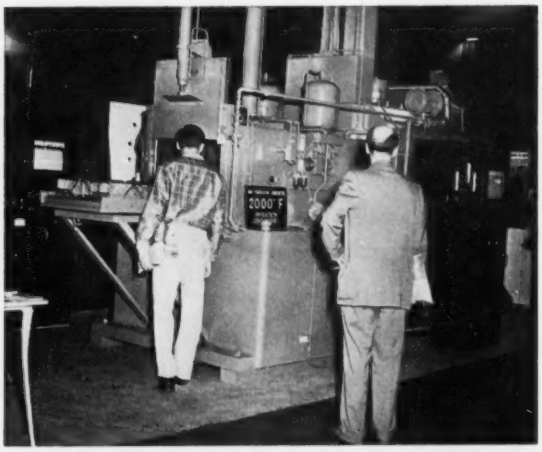

Fig. 1—Western Metal Show exhibit of Ipsen Industries, Inc., Rockford, Ill.

H. N. Hill, chief of the engineering design section at Alcoa Research Laboratories, asserted in a dissertation on the thermal cycling of aluminum alloys, that residual stresses resulting from differential cooling rates during quenching can lead to warpage during machining.

Conventional methods of reducing residual stresses, Hill continued, can only be used for most irregularly shaped parts—such as die forgings, where a sacrifice of mechanical properties is allowable. On the other hand, he maintained that thermal cycling can greatly reduce residual stresses in such parts without affecting mechanical properties.

Steel Heat Treating Forum

Participants in an opening forum on steel heat treating carbon control included Dr. L. Schapiro, chief metallurgist for Douglas Aircraft Company's Santa Monica Division; O. E. Cullen, manager of research and development for Surface Combustion Company; W. R. Varney, superintendent and chief metallurgist for Calmec Manufacturing Company; R. H. Lundquist, vice-

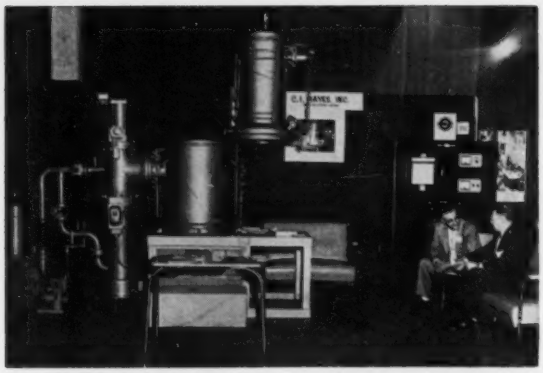

Fig. 2—The exhibit of C. I. Hayes, Inc., Cranston, R. I.

president of California-Doran Heat Treating Company; M. Tiktinsky, materials and process development engineer for Lockheed Aircraft Corporation; J. C. White, test engineer for North American Aviation, Inc.; and the aforementioned N. K. Koebel.

Topics covered by the latter panelists were exothermic and endothermic gases, manual and automatic controls, CO_2 and other dewpoint control constituents, the genetics of steels' reactions with atmospheric gases, primary parameter control methods which promote desired reactions, atmospheric stabilization, and sampling equipment.

The present and future importance of heat treating was brought out in several ASM sessions on other subjects. Donald E. Nulk, senior project engineer in charge of design metallurgy for Thompson-Ramo-Wooldridge, Inc., Cleveland, for example, averred that new metals with reduced impurities—such as nickel-bearing alloys containing such reactive elements as titanium, aluminum, zirconium, and boron—are necessitating radical changes in heat treating techniques and quality control methods.

The objective, he added, is to retain or improve the essential properties of the new materials so as to meet the demands in modern technology for lower safety factors in metal products.

Virgil W. Whitmer, assistant chief metallurgist, and Thomas E. Perry, staff metallurgist, of Republic Steel Corp., Massillon, Ohio, further had some interesting things to say about work recently accomplished with 301 stainless steel—an austenitic material which is being produced as 0.0060" gage strip with as-rolled yield strengths slightly above 250,000 psi.

"After aging," they reported, "parts made from this material have yield strengths of more than 300,000 psi and gage variations within 0.00050".

American Welding Society Sessions

In a joint session held by the ASM and the American Welding Society, resident chief metallurgist Glenn B. Pritchett of Solar Aircraft Company, San Diego, contended that—while numerous metals can be welded and heat treated to ultra-high strength levels, as determined by tensile tests—burst tests of pressure vessels and missile casings have shown that many heat treated alloys lack ductility in welded areas.

The tests, he said, were run in evaluating metals that had been heat treated to ultimate tensile strengths in the 225,000 to 300,000 psi range.

Hydrogen embrittlement of high-strength steels was the subject of ASM papers presented by Attwell M. Adair, task scientist for the metallurgy research branch of the aeronautical research laboratory at Wright-Patterson Air Force Base, Ohio; B. F. Brown, head of physical metallurgy at the Naval Research Laboratory, Washington, D. C.; and Paul W. Kloeris, Jr., metallurgical engineer for Douglas Aircraft Company's Santa Monica Division.

Adair first pointed out that hydrogen pressure within voids, microcracks, or areas under high tri-axial stress has been proved to be one of the main causes of unpredictable failures of steels in weapon systems. Added Brown:

"Some high-strength steels are susceptible to stress-corrosion cracking, manifestations of which may resemble hydrogen embrittlement. Distinction between these different mechanisms can be made in the laboratory by observing the effect on cracking behavior when small electric currents are impressed upon a stressed specimen immersed in corrodent."

Fig. 3—Pacific Scientific Company, Los Angeles, Calif., had this exhibit.

Kloeris went on to say that hydrogen and corrosion embrittlement in 4340 ultra-high strength aircraft steel (heat treated to 260,000 to 280,000 psi ultimate tensile strength and stressed above 60% of yield strength) can be avoided by proper cleaning and plating followed by baking and painting.

"Acid cleaning is severely embrittling and must be avoided," he explained. "Plating can be controlled to produce only mild embrittlement, which can be relieved by baking (the amount of relief being directly proportional to the amount of baking time). Cadmium plate

(Continued on page 38)

PRODUCT BOYCOTTS

By **W. B. THOMAS**
National Chamber of Commerce Special Committee on Secondary Boycotts

COMEDIAN GEORGE GOBEL usually gets a bevy of belly laughs when he impishly wisecracks: "You can't hardly get them no more."

When Gobel says it, it's funny. When it happens in real life, it's tragic—especially when a private organization is helping to keep goods and services off the market.

Many persons are unaware of a power to limit the public's freedom to buy the products it wants or to hire the workmen it wants. Yet such power now exists in the hands of certain labor union officials. Not all union officers would use it, but enough have taken advantage of it to make corrective legislation mandatory.

In most cases the attempt to keep a product from being sold is a temporary tactic to help win a strike or push over an organizing drive, but there are occasions where it is an all out fight to crush a business enterprise. Such permanent product boycotts follow jurisdictional disputes between unions, cases where a union has lost a strike and wishes to continue the vendetta, or incidents where workmen prefer to refrain from joining a labor union.

The now famous remark of a United Auto Worker's international representative, Donald Rand, is a classic example. Rand was quoted in an interview with a *Wall Street Journal* writer during the height of the violence-ridden strike against the Kohler Co.

"It seems to me that it is almost sinful to have any labor dispute degenerate to the point where this one has—where we actually have to wreck the company. That's what we're doing, wrecking the company."

The American public is hit by all sorts of hidden product boycotts. Manufacturers, wholesalers, and retailers are all brought into the picture at one time or another. There is no boundary line for the kind of product or the type of service that can be hit.

The Painters' union has its restrictions on the use of multi-color paint, on the use of spray painting, and the size of paint rollers. The Teamsters have tried to keep non-union truck lines from hauling freight, and to keep warehouses, whose employees do not want to join the Teamsters, from getting freight especially consigned to them.

The Hatter's union objects to non-union Texas and Kentucky hat manufacturers selling hats in other sections of the country.

Ohio industrial ventilators for the roofs of new factories have remained unloaded in freight cars for months, because they were made by members of the Steelworkers union instead of the Sheet Metal Workers union.

Such varied products as hospital doors, pre-glazed window sashes, wooden stairways, heating pipe and fittings, bathtubs, cakes and cookies, whiskey, penicillin, vending machines, eggs, rubber heels, hats, and even church pews have felt the scourge of the infamous product boycott.

Why certain products can be kept from use and why certain persons can be prevented from doing a particular type of work is the result of loopholes in our national labor laws.

When the Taft-Hartley act was passed in 1947 one of the foremost problems was to put an end to the secondary boycott. Congress made the secondary boycott an unfair labor practice by unions, and thought it was bringing an end to this tactic.

But the law contains loopholes and the secondary boycott is still with us. Today we have legal and illegal secondary boycotts; the legality is determined by the technique the union official uses in employing the unfair weapon.

The secondary boycott is the tool to keep products and services from the public, and it is accomplished by bringing economic pressure on secondary or third-party

employers. They are pressured by the union boss to stop doing business with a person or to stop buying a particular product under the threat of "labor trouble."

In other words it is a threat to stop doing business with your neighbor or the union will see that no one does business with you.

The boycott can take two forms—a product may be its direct target or the employee who makes or services the product may be its immediate victim. The general public is the eventual victim.

A current major product boycott is the campaign of the United Rubber Workers of Akron, Ohio, to keep O'Sullivan heels from being worn by Americans. Until recently most cobbler shops displayed window posters advertising O'Sullivan heels as "America's number one heel." Nearly all of these posters have disappeared. O'Sullivan heels are available in some shoemaker shops, but one usually has to request them or a competitor's brand will be used. This boycott is the result of a contract dispute between the United Rubber Workers union of Akron, Ohio, and the O'Sullivan Rubber Co. of Winchester, Va. The union no longer represents O'Sullivan's employees, but the boycott continues.

St. Louis housewives in 1953 discovered that some butcher shops were not carrying Swift products. They disappeared when the Butchers union brought pressure on retail stores to stop ordering Swift meats unless Swift & Co. salesmen joined the union.

In California the Meat Cutters union sought labor contract clauses with food stores to prevent the use of frozen, prepackaged products unless they were cut, prepared and packaged on the premises and dispensed by members of the Meat Cutters local.

One of the most amazing types of product boycotts came to light during the Senate Labor Rackets committee investigation of the Teamsters in Oregon.

Howard Morgan, an Oregon public utilities commissioner told the McClellan committee on March 1, 1957, that a report was made to him that $10,000 was being offered for a seat on the state liquor commission. The objective, said Morgan, was to bar from Oregon whiskies produced by eastern distillers whom the Teamsters were fighting.

Boycotts against workmen in the service field are numerous. In the St. Louis area for example, certain unions prevent a contractor from hiring a particular craftsman directly. The contractor must first hire a sub-contractor to get the craftsman.

In Baltimore a small erecting company that employs union labor exclusively has boycott problems. Union officials do not want this firm to do business with non-union general contractors.

The loss of choice from a secondary boycott is not merely a restraint upon purchasing. It sometimes limits the right to make and sell a product. This is illustrated by the experience of a number of warm air heating contractors. Many of these contractors are wasting time and money making their own furnace fittings, instead of buying them. The increased cost eventually is passed on to the public.

The Air Distribution Institute of Cleveland conducted a survey of the fitting market a few years ago. They employed a professional research firm to check three cities—Chicago, St. Louis and Cleveland—making personal calls on more than 100 heating contractors. The survey concluded:

"Unions are, without question, a major deterrent to contractors buying, instead of making, their furnace fittings. This insistence on a contractor maintaining his own sheet metal shop frequently persists when factory-built fittings are available from manufacturers with employees belonging to the same over-all union." Current reports from manufacturers indicate no change in the situation since the time of the survey.

One Cleveland contractor revealed that he was forced to use inferior fittings because of an insistence that they carry a certain union label.

A Kansas City, Mo., firm, the E. K. Campbell Co., has difficulty in having its large warm air furnaces installed in Long Island, N. Y., school buildings unless the casings bear the Sheet Metal Workers label. The Campbell Co. not only employs union labor, but operates under a union shop contract.

The product boycott is another demonstration of the monopoly power of labor union officials. It will not be stopped until the power of the professional unionist is curbed.

There is no intention or suggestion of legislation to "bust" unions or to interfere with legitimate collective bargaining activities, but there must be a demand for Congress to remove the power for any organization whether it is a union, a trade association, or employer group to control, limit, or restrict the public's freedom to buy or use what it wishes.

Many members of Congress are aware of the secondary boycott problem. Senator Curtis (R.-Nebr.) has termed it the most vicious of union unfair labor practices, second only to violence. He has introduced legislation to close the secondary boycott loopholes in the Taft-Hartley act.

Senator McClellan (D.-Ark.) has emphasized that "further legislation is needed in the secondary boycott area."

President Eisenhower, in criticizing the so-called Kennedy-Ives labor reform bill, pointed to its lack of secondary boycott relief. The president said:

"Further, the bill's failure to deal with the problems of boycotting and blackmail picketing would have given greater impetus to abuses the American people want to curb."

Action by Congress, however, is proportionate to the action taken by the constituents of congressmen. In other words businessmen and the public must not only ask but insist upon relief.

The alternative to inaction is obvious: "You can't hardly get them no more." • • •

CONTROLLED CARBURIZATION INCREASES LIFE OF DRILL STEEL

By **FLOYD ANDERSON,** Chief Metallurgist
Gardner-Denver Company
Quincy, Illinois

A NEW controlled carburization process developed in the metallurgical laboratories of the Gardner-Denver Company's division in Denver, Colorado, has increased the life of drill steel for hardrock drilling up to ten times the original life span.

While carburization itself is an old process of using heat to increase the carbon content of low-carbon alloy steel surfaces in order to produce highly-hardened surfaces that will stand up under the stress and strain of long-hole drilling, there has always been the problem of controlling the amount of carburization. Over-carburizing the steel produces a rod that is too hard and too brittle. Such brittleness increases the chances of "frozen-carrot" breakage of drill rods while in operation. As a result, mining and construction industries have had to be content with a soft, plain carbon or alloy drill steel. This soft tool, if it did not break during drilling thus necessitating costly extraction of the broken equipment, had to be reconditioned by grinding after a normally limited operation. Even after reconditioning, the drill rod could be depended upon for only one-half of its original service.

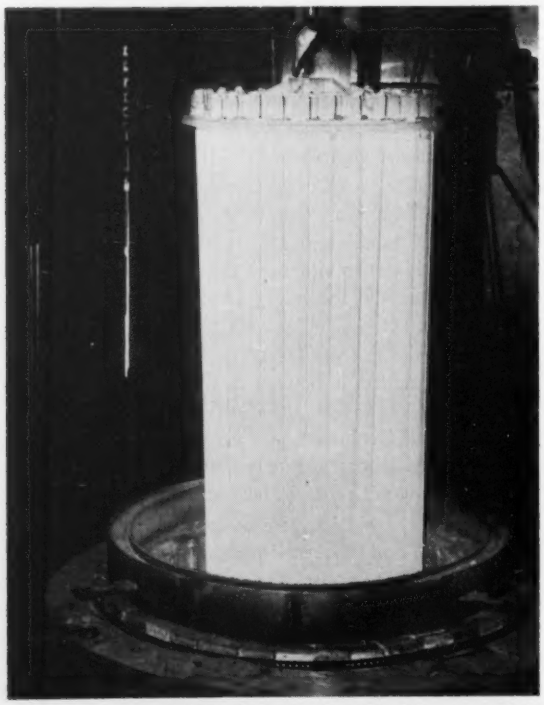

Fig. 1—A carriage of drill rods has just been lifted from one of the pit retort furnaces at the Gardner-Denver Company plant in Denver. The furnaces—the only ones of their type in the world—must be kept at steady, specified temperatures in order to heat the drill steel properly. Steel is white hot when it is lifted from the furnace.

The Gardner-Denver method of heat treating low carbon alloy steel has produced drill steel that will perform more efficiently up to ten times the footage before being discarded. Although this figure has been surpassed, company metallurgists claim a usual ten to one ratio of comparative performance.

The metallurgists at Gardner-Denver trace the beginning of their process back several years when it became evident that rising drilling costs were demanding durable and long-lasting equipment for field operations. After exhaustive research, confronting new and complex problems such as how to straighten the steel rods into usable shape after heat treating, the metallurgists came up with what has proved to be the answer to quick-breaking and quick-wearing drill steel. Many of the problems were solved by the old trial and error methods.

In our new process, both the external and internal surfaces of hollow drill rods are hardened to the proper degree, while the center or core of the piece remains tough and impact-resisting. What the hardened surface lacks in drilling flexibility, the softer core counteracts. The shortcomings of the soft core, on the other hand, are offset by the highly-hardened surfaces.

The Denver division receives its A4320 carburizing alloy steel in special, hollow bar stock from which it is fabricated into the rods required in drilling. The rods are taken to a forge for up-setting, threaded in Warner-Swasey automatic chucking lathes and then moved to the heat treating department. At heat treating, the tube holes are filled with a solid fine granular proprietary compound carburizer, loaded into suitable fixtures and suspended vertically into either of two gas-fired, vertical pit retort carburizing furnaces. The furnaces—the only ones of their type in the world—are complete with temperature controllers that maintain a heat of 1700°F for a length of time determined by the size of the rods being treated, and the desired depth of case hardness. The carburizing gas, especially prepared to control the carbon content of the case is an endothermic type op-

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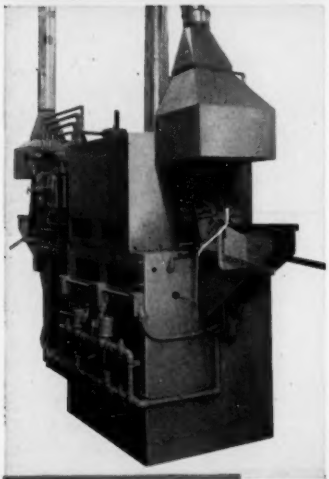
Pacific

BRAZING FURNACES

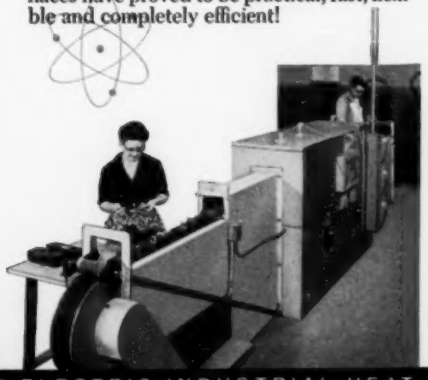
are specifically DESIGNED to meet the *critical* requirements of

ELECTRONIC MANUFACTURERS



The close tolerances demanded today in the design and manufacture of electronic parts in order to make them smaller and more heat resistant — have called for new concepts in furnace design. Faster handling methods, automatic controls and consistently even heats — have required the design and construction of a wide variety of furnaces to meet the varied and special needs of the electronics industry.

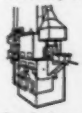
In every installation, Pacific Scientific Furnaces have proved to be practical, fast, flexible and completely efficient!



BOX TYPE BRAZING used for medium temperature brazing up to 2100°F. Movable loading rack at front of furnace aligns with furnace hearth during loading and automatically retracts, clearing area for door to close. Has integral atmosphere-tight water-jacketed cooling chamber.

DOUBLE ELEVATOR — for brazing Klystron tubes. In this two station, one furnace system, hydraulic rams alternately raise and lower work into brazing retort and through water-jacketed cooling chamber. Furnace temperatures maintained by multiple zone control system.

FULL RETORT DU-AL — for laboratory and research use. Also excellent as production unit. Design includes separated purge, heating and water-jacketed cooling chambers. Full alloy muffle with no exposed brickwork allows use of extremely high purity atmosphere.



HEATED TUBE provides rapid heating by utilizing retort as heating element. Goes from ambient to 2200°F. in 12 minutes! Water-jacketed cooling chamber located at discharge for fast cooling cycles. No exposed brickwork allows use of inert or reducing atmospheres.

CONVEYOR BRAZING shown here being loaded with wave guide assemblies for silver alloy brazing. Design provides for preheating of parts prior to entering brazing chamber. Multiple zone control for precise temperatures. Suitable for use with atmosphere.

WHATEVER your heat-treating needs — or production requirements — a Pacific field engineer will be glad to discuss it with you. Write or call today!

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NEW QUENCHING BATH CHEMICAL

By **MACK GORDON**
J. Hannan Company
Cleveland, Ohio

A WATER SOLUBLE chemical has been developed as a result of a need in the metalworking and heat treating industries for a quenching bath which cannot catch fire and which has no obnoxious odors.

Manufactured under the name of "Hannite," a solution of this chemical in water forms a near-perfect solution. This means that there are no undesirable sludges or suspended matter in the water solution when directions are followed. The solution is colorless, will not cause dermatitis, will not deteriorate, and is safe to handle.

The heat quench properties of the chemical can be controlled by varying the concentration. Shown in the illustrations are curves showing these properties plotted against a conventional oil used in quenching baths. Fig. 1 shows the quenchant time of oil and two concentrations of "Hannite." The spread which is shown by the curves is present in all quenching baths depending on the position of the measuring thermocouple. The curve in Fig. 2, which is a conventional curve, shows the mean of the data derived on the curve in Fig. 1.

The new quenching chemical can be used in the foundry field in the production quenching of castings, in the machine parts industry, and in the automotive industry for the quenching of gears, bolts, nuts, cams and other parts. It is also presently being successfully used in induction and flame hardening operations. It is possible to tailor fit, within limits, a quenching curve for specific applications. It is also possible to withdraw metal from the quenching bath above the customary temperature as used with oil and thereby impart physical properties not heretofore obtainable without the hazard of fire.

For induction hardening "Hannite" can be obtained with a special rust preventive so that no rust will occur in the induction hardening equipment.

To make a solution containing the new chemical, the material should be spread on water surface in a thin layer. The bath should be constantly agitated so that the layer becomes wet and is carried below the surface. Another layer is then spread on the water, and it is possible by using the above method to completely dissolve a bath in three quarters of an hour. If "Hannite" is dumped into a water bath and not spread upon it, it may require up to twenty-four hours of agitation to dissolve it and make a perfect solution. When it is completely dissolved, there are no lumps or gelatinous

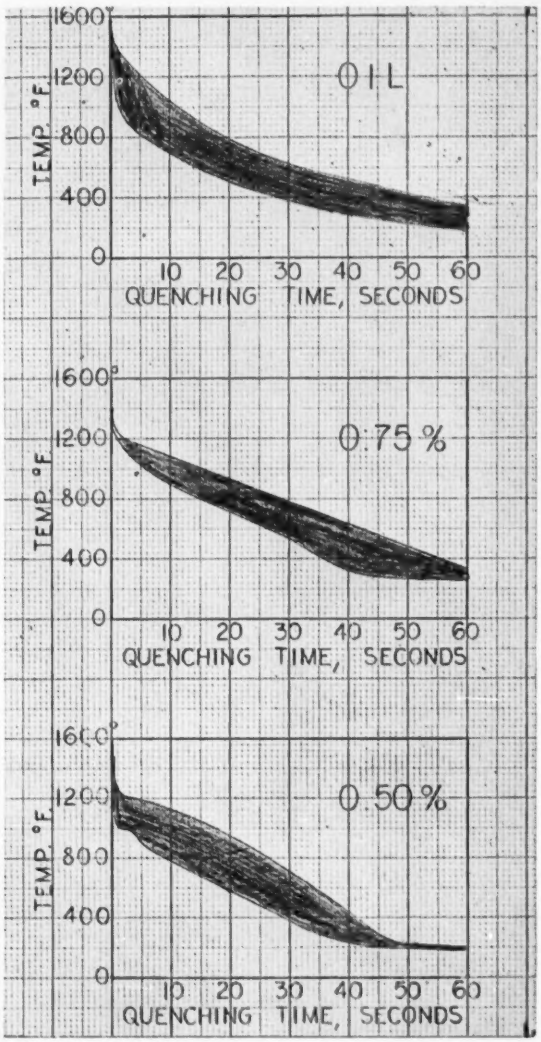

Fig. 1—Curves showing the temperature—time quenching comparisons for oil and solutions containing different concentrations of "Hannite."

(Continued on page 52)

AT THE HOMESTEAD WORKS OF U. S. STEEL National Alloy Rollers carry USS "T-1" plate up to 45 feet long, 13 feet wide, and 2 inches thick through heat treating furnace.

AT LUKENS STEEL National Alloy Rollers have been in service more than 2½ years where plate up to 172 inches wide and 3 inches thick is heat treated.

National Alloy Rollers provide long service on Drever continuous plate Heat Treating Lines

Establishing better properties in steel plate through heat treating has become a continuous, high output operation at leading steel producers. As the leading specialist in high temperature, high alloy castings, National Alloy, cooperating with Drever, engineered, centrifugally cast and produced some of the largest high alloy rollers now in use to handle plate up to 3 inches thick and 172 inches wide. These rollers vary in diameter from 8 to 14 inches and are 20 feet long.

Meeting the ever-increasing demands of industry for high temperature, high volume equipment has given National Alloy unmatched experience in the development and manufacture of high alloy castings for maximum service. Consult National Alloy for a practical answer to your high temperature and high corrosion problems.

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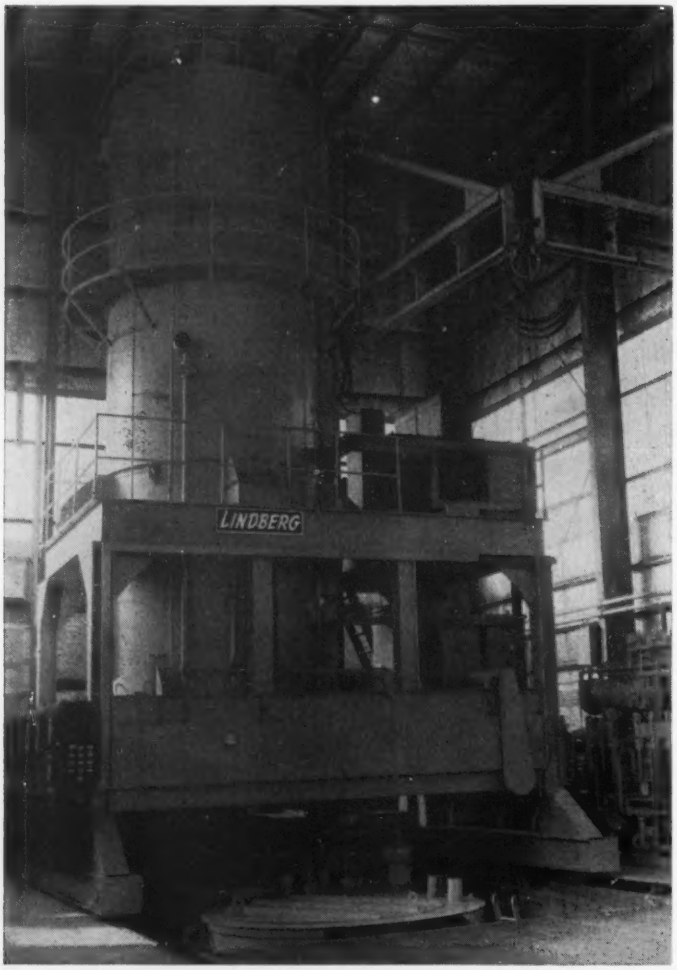
National Alloy Division, Pittsburgh 38, Pennsylvania

NEWS TO HEAT TREATERS...

NEW CONTROLLED ATMOSPHERE HARDENING FURNACE

The Lindberg Steel Treating Co., Melrose Park, Ill., has just completed the installation of a controlled atmosphere hardening furnace with bottom loading and discharging and which spans a pit containing an atmosphere quench chamber, a salt quench tank, a rinse tank, and a draw furnace. The installation was built by the Lindberg Engineering Co. of Chicago.

The furnace shell (11′ in diameter by 35′ deep) is welded gas tight throughout to prevent contamination of the atmosphere by air infiltration and will accommodate a loading fixture with an effective work load 24′ long by 80″ in diameter. The work chamber is lined with high-quality, light-weight insulating refractory, backed by courses of medium and low temperature insulating slabs. Heating elements employed for temperatures to 2050°F are of 80% nickel—20% chromium analysis and are mounted on the refractory in tiers so as to provide 500 kw. in five zones of control. The five zones allow for maximum temperature uniformity regardless of the length of the work piece being heat treated. Elements are also installed in the roof and in the bottom door. The elements are controlled by saturable core reactors.



This atmosphere controlled, bottom quench, gantry-type hardening furnace and associated equipment has been installed in a new building in the heat treating plant of Lindberg Steel Treating Co., Melrose Park, Ill.

The furnace is mounted on four wheels on rails which allow the furnace to travel along the length of the furnace pit. Five circular scale indicating pyrometer control panels, one for each zone of control, operate the reactors. The furnace temperature is recorded by two 24-point strip-chart recorders: one for O°F to 1200°F and one for 1000°F to 2200°F. These panels are also mounted on the side of the furnace framework.

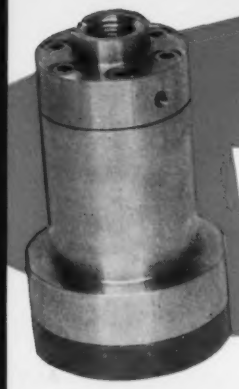
The following auxiliary units complete the heat treating installation:

(a) 6000 cfh Hyen endothermic controlled atmosphere generator which produces the atmosphere required. The atmosphere is produced by cracking the hydrocarbon constituents (methane, ethane, etc.) of natural, artificial, propane, or butane gas with air over a heated catalyst to produce carbon monoxide and hydrogen. Full capacity of the generator is used to purge the furnace chamber, for a predetermined time after charging load, by means of a by-pass and time delay relay.

(b) Carbotrol—A Lindberg developed instrument which automatically controls the carbon potential of the furnace atmosphere to be in balance with the carbon content and temperature of the charge.

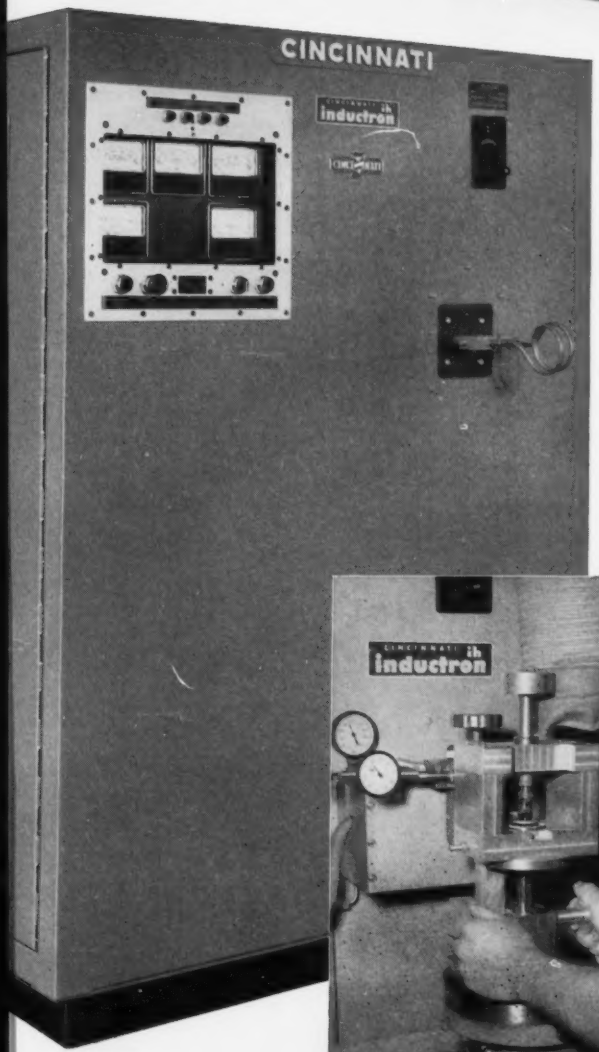
(c) Combination atmosphere quench chamber and loading station —Size: Effective opening diameter —7′-0″, Depth: 27′-0″." A "turtle neck" locks this chamber to the furnace so that parts can be charged and discharged without contact with the air. This chamber is water-jacketed so as to provide effective cooling rates when quenching into an

(Continued on page 14)



with just a KISS of 1000 kc's

CINCINNATI inductron® precision-brazes Statham Pressure Transducers



Photos above show Cincinnati Inductron induction heating machine and close-up of fixture used to braze 150 different sizes and styles of pressure transducers. Hose over fixture exhausts heat. One type of completely assembled Statham Pressure Transducer is shown, above, actual size.

Statham Instruments, Inc., Los Angeles, required a brazing operation before the final assembly of their extraordinarily accurate pressure transducers. These instruments record pressures ranging from fractions to thousands of psi. Among other sensitive components, the coils in these instruments are wound from wire so fine that it floats in air. To braze these transducers, the heat must be precisely located and applied . . . or a nearly complete, accurately adjusted instrument will be destroyed.

Because of its precise control of high frequency output (up to approx. 1200 kc) a Cincinnati 15 KW Inductron was the economical solution to this assembly problem. Brazing three joints is typical of the work accomplished. Using a calibrated fixture on an adjustable table for exact work positioning, the joints are quickly brought up to brazing temperature. The heat cycle for some transducers is but 0.2 second—just a kiss of 1000 kc's. With the Inductron's variable output RF transformer—rotating a dial varies the heating characteristics of the coil—only 25 different coil forms are needed to braze 150 instrument sizes and styles.

For your heat processing work, look to the Cincinnati Inductron for lowest cost induction heating . . . and to the Cincinnati Flamatic for lowest cost flame heating. Call in a Meta-Dynamics Division field engineer for full details.

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NEWS TO HEAT TREATERS

(Continued from page 12)

inert atmosphere such as argon or nitrogen.

(d) Salt Quench Tank—heated by four radiant tubes. Rated heat input: 4,000,000 B.T.U./cu. ft. Size: Effective opening diameter: 7′-4″. Effective depth: 25′-0″. Used for quenching parts after heating in atmosphere furnace. Two 15 H.P. agitators recirculate the salt over the gas-fired immersion heating and cooling tubes and through the work load to insure complete transformation when quenching.

(e) Hot Water Rinse Tank—heated by two radiant tubes. Rated heat input: 2,000,000 B.T.U./hr. Size: Effective opening diameter 7′-4″. Effective depth: 25′-0″. Used for rinsing parts after immersion in salt quench tank.

The unit is designed to handle present and all foreseeable future requirements for production of rocket motor cases. It will also be available for other applications of large parts which must be heated in atmosphere, and quenched in either atmosphere or hot salt.

For further information circle No. 1

SCIENCE INDUSTRY CENTER

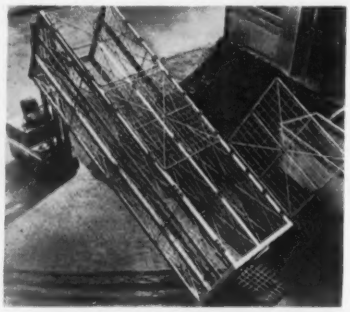
Washington-Rockville Industrial Park, a science industry center, has been established to meet the needs of science-oriented industries seeking suitable accommodations at the nation's capital. Designed to meet the growing demand for efficient plant sites as well as prestige location, the center is minutes away from key government agencies, in nearby Montgomery County.

Proximity to key government agencies, unparalleled research facilities, the high concentration of scientific, engineering, and administrative personnel, and the strong marketing position of the national capital as well as the close contact with scientific societies, trade associations, and foreign embassies has made the national capital area the nerve center of scientific and defense research and development.

For further information circle No. 2

STAINLESS STEEL BASKET

This stainless steel basket shown here is used to carry close-tolerance steel tubes at approximately 1250 F to 1350 F in a pit annealing furnace. Annealing is followed by a



quench. The basket handles a load of approximately 3000 pounds. Baskets are manufactured by Rolock Incorporated, Fairfield, Connecticut, for Salem-Brosius, Inc., Carnegie, Pennsylvania.

For further information circle No. 3

AIR POLLUTION MEETING

The annual meeting of the Air Pollution Control Association will be June 22-26 in Los Angeles. This meeting will include technical sessions and exhibits. At the technical sessions papers will be presented by outstanding authorities covering the control of air pollution. Copies of the papers will be on sale during the meeting.

FURNACE SALES AGREEMENT

Lindberg Engineering Company, Chicago, Ill., has announced the completion of a national sales agreement with Upton Electric Furnace Company, Roseville, Mich. Under this agreement Lindberg can offer industry a complete line of high- and low-temperature salt bath furnaces for production, pilot plant, or laboratory requirements.

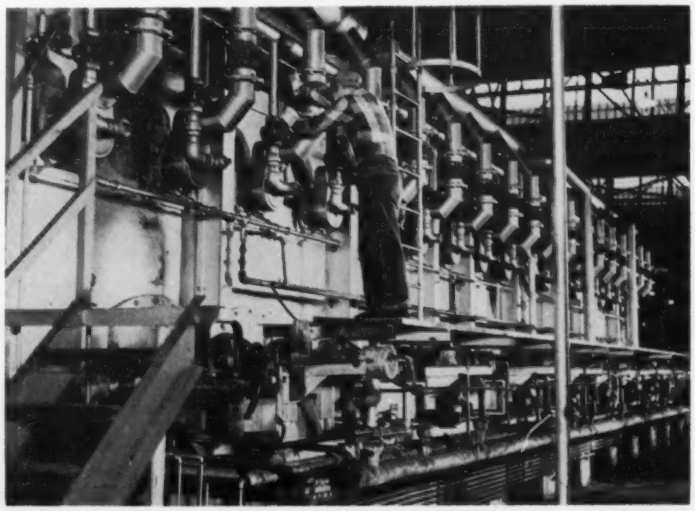
"WALKING BEAM" FURNACE

To increase its tempering and normalizing capacity and improve these operations on Spang seamless tubular products used largely in the oil fields, The National Supply Company has installed this natural gas fired "walking beam" furnace of 35-tons-per-hour capacity in its Ambridge, Pa., plant. The furnace was manufactured by Salem-Brosius, Inc. of Carnegie, Pa.

In addition to ensuring uniform heating of pipe, the furnace takes little more space than the 8-tons-per-hour furnace that it replaced. It is 52′ long and 56′ 3″ wide. The heating chamber is 5′ high. When operating at capacity there are 53 lengths of pipe moving continuously through the new furnace. Tempering and normalizing temperatures are closely controlled between 1000° and 1650°F.

For further information circle No. 4

(Continued on page 30)



JANUARY—Bought anhydrous ammonia at bargain price on supplier's vague quality claims . . .

LATER—Moisture in furnace . . . discoloration of finished parts . . . pickling and polishing necessary . . .

STILL LATER—Oil! Pressure regulators clogged . . . dissociator catalyst poisoned . . . incomplete dissociation . . .

TOO LATE—Parts and profits in scrap pile . . . metal treating line down for replacements and repairs . . .

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THE APPRENTICE CORNER

Editor's Note: This is the first article on this topic of a series which will be published in the next several issues. They have been abstracted from the book "Modern Principles of Heat Treatment of Steel" just published by Uddeholm Company of America, Inc., who furnished the photographs and granted permission to publish these articles.

MODERN PRINCIPLES OF HEAT TREATMENT OF STEEL

The versatility of steel depends largely on the different properties which can be imparted by suitable alloys and by heat treatment. The basic heat treatment procedures of annealing, to soften the steel, and hardening, to harden the steel, have long been known; but it is only in recent times that the full significance of these procedures has been understood. It has been found that the mechanical properties are dependent largely on the microstructure, that is, the composition and form of the small grains which collectively make up the steel. In this connection the microscope is indispensable in the investigation of the structure of steels.

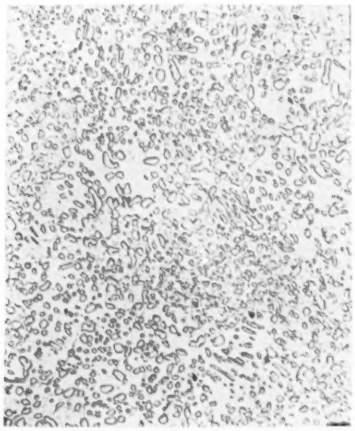


Fig. 1—Microstructure of soft annealed steel. Spheroidized grains of cementite in matrix of ferrite. x 500.

The major importance of heat treatment is that it affects the microstructure of the steel. To understand clearly the behavior of steel in the various stages of heat treatment, the so-called S-curve, TTT-diagrams or IT-diagrams are invaluable and these are now generally available. The term S-curve is a relic from the early investigations when due to misinterpretation of the transformation in the martensite range, a curve was drawn in the form of a letter S. Nowadays, the terms TTT-diagrams (derived from Temperature-Transformation-Time) or IT-diagrams (derived from Isothermal Transformation) are more commonly in use.

As an introduction to a comprehensive description of the more usual heat treatment methods, a short explanation of the meaning of the TTT-diagrams will follow.

Meaning of the TTT-diagram

Apart from certain low carbon and austenitic steels, annealed steel at room temperature contains two main constituents: ferrite and cementite which can be studied on etched test pieces under the microscope.

Fig. 1 Cementite is a combination of iron and carbon, the carbon being about 7 per cent, and consisting of rounded grains distributed in the matrix.

The carbide forming alloys, chromium, tungsten, and vanadium, are mainly combined in the cementite; whereas alloys such as silicon and nickel are found more in the ferrite.

If a steel of similar annealed structure to Fig. 1 is heated, no change takes place in the structure until the transformation temperature A_1 is reached. At this point, ferrite and cementite combine into a solid solution called austenite. The transformation temperature varies according to the analysis of the steel. With unalloyed steels it is 1345°F and for alloy steels it normally lies between 1245° and 1425°F. Although the steel has passed the transformation temperature, it does not normally follow that the structure becomes completely austenitic as austenite may exist along with ferrite and cementite within a certain temperature range above A_1.

Fig. 2 shows a section of the Iron-Carbon diagram indicating the transformation temperature A_1, for an unalloyed steel. The temperature range (the shaded portion) indicates the transformation from ferrite and cementite into austenite on

(Continued on page 18)

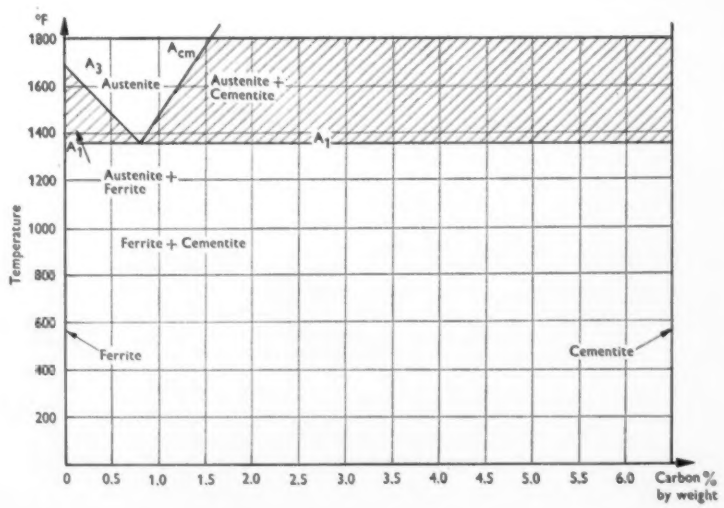
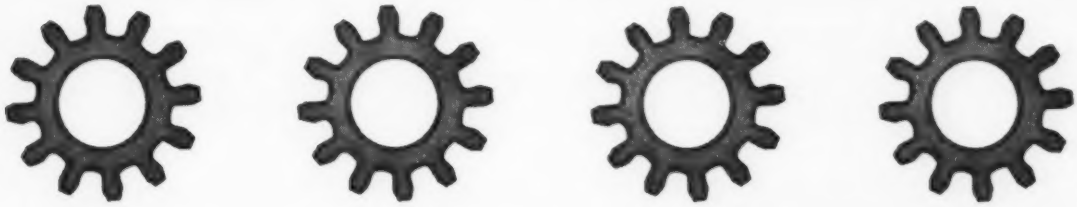


Fig. 2—Section of the Iron-Carbon diagram.

For Automatic Quality Control



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(Continued from page 16)

heating steels of different carbon contents, and a few examples may explain this more clearly.

A 1.5 per cent Carbon steel starts to transform at about 1345°F and the ferrite combines with part of the cementite to form austenite. The result will be austenite with a surplus of cementite, but on further heating the cementite will gradually transform until at about 1790°F the whole structure has become austenitic. Steels with a carbon content lower than 0.80 per cent behave similarly except that the cementite first combines with the ferrite, the surplus ferrite transforming on further heating above A_1. Steel of 0.80 per cent carbon is completely transformed to austenite at 1345°F.

The transformations mentioned above take place when the steel is heated, but similar changes occur when it is cooled slowly. If cooling takes place quickly, an austenitic structure is retained below A_1 which obviously is at variance with the iron-carbon diagram. Austenite which has been cooled to below A_1 so quickly as to prevent transformation is termed "retained austenite." This phase is obviously unstable and in time transforms to the stable constituents of ferrite and cementite.

As to the TTT-diagram, this shows in graphic form the time required by retained austenite to transform at a constant temperature.

Fig. 3 shows a typical TTT-diagram for an unalloyed steel containing 1 per cent carbon. Of all the C-shaped curves, that on the left shows the time required for the transformation of 1 per cent of the austenite; whereas that on the right refers to 100 per cent austenite. As can be seen, the transformation is most rapid at about 1070°F where it commences in less than one second and is complete after about five seconds.

The TTT-diagram is usually based on the results of a series of experiments with small test pieces heated to an austenitic condition and quenched in a metal or salt bath at different temperatures below A_1. The transformation of the austenite in these test pieces may then be studied under a microscope.

The products formed by transformation of the austenite can be classified into three groups. Within the higher temperature range from A_1 to about 930°F, pearlite is formed; from about 930°F to about 390°F bainite results; and at lower temperatures martensite is produced. The produced hardness after complete transformation at different temperatures is often given to the right of the curve.

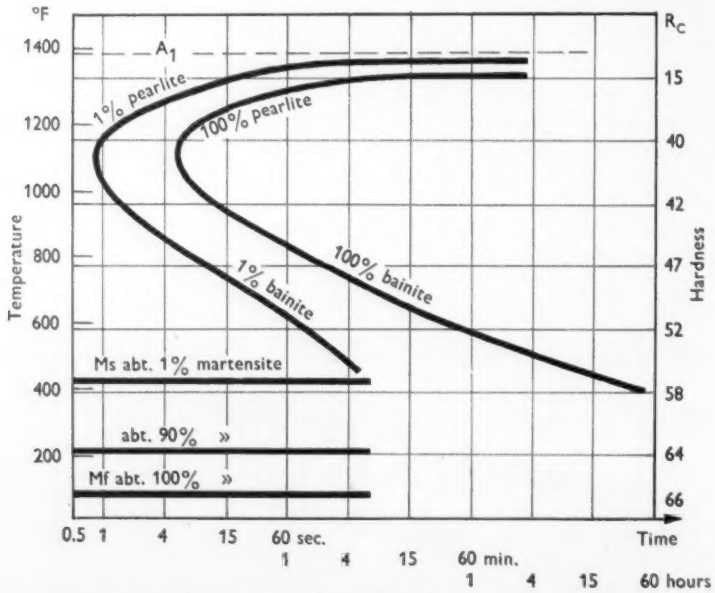


Fig. 3—TTT-diagram for an unalloyed steel of 1 per cent carbon.

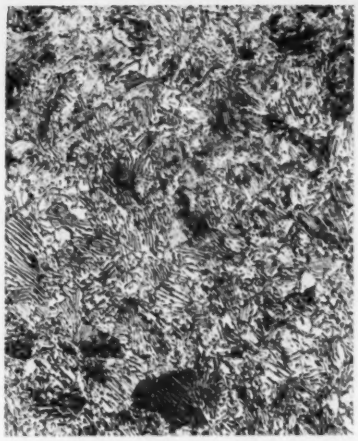


Fig. 4—Pearlitic structure. Laminar arrangement of cementite and ferrite. x 500.

Pearlite and bainite both consist of ferrite and cementite but with a different microstructure to that of the annealed steel. The cementite is not now in rounded balls in the ferritic base but in pearlite it is in lamellae arranged in parallel, Fig. 4, and in bainite it is in small needles, Fig. 5.

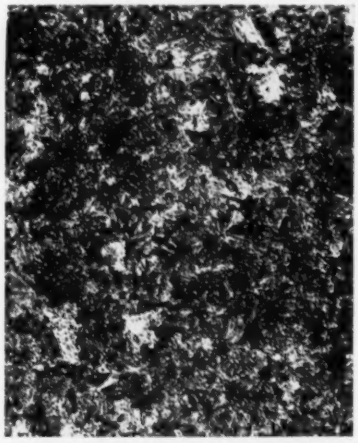


Fig. 5—Bainitic structure. Cementite-needles in ferrite matrix. The structure is so fine that detail is difficult to distinguish. x 500.

In pearlite as in bainite the cementite becomes increasingly fine grained and harder when the temperature of transformation becomes lower. This is due to the fact that cementite is precipitated from austenite by diffusion or the move-

(Continued on page 43)

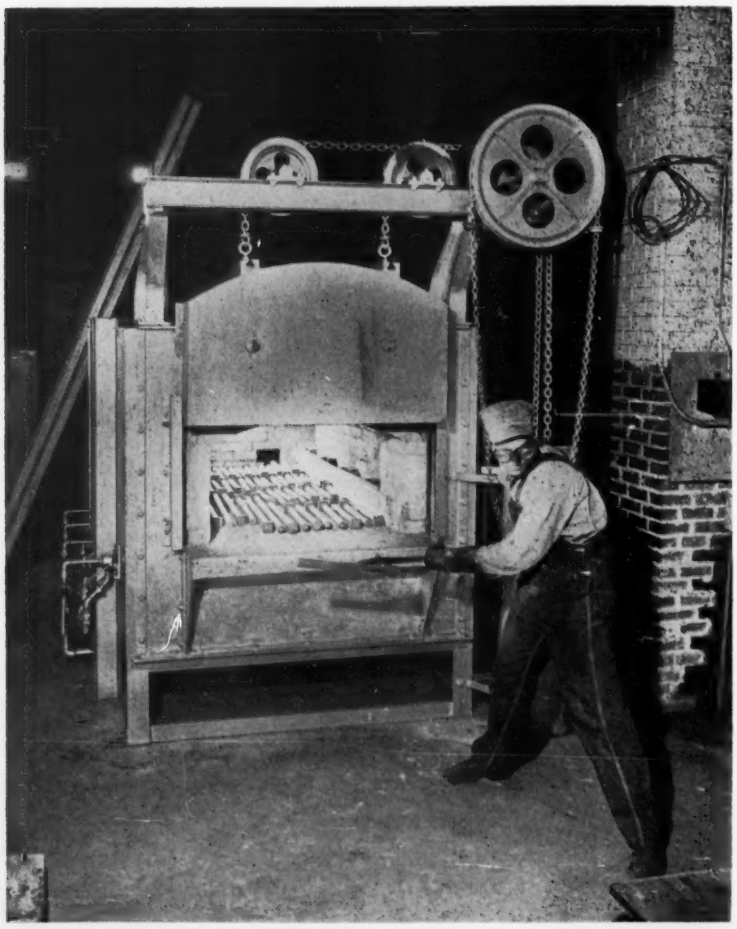
HEAT TREATING HINTS

MANUFACTURING COSTS REDUCED AND HEAT TREATING OPERATIONS IMPROVED BY GAS-FIRED OVEN FURNACE

Considerable savings in manufacturing costs and general over-all improvement in heat treating operations have been the experience of the St. Louis, San Francisco Railway Company, Springfield, Missouri, replacing a shop-built, oil-fired furnace with a new Sunbeam Heavy Portable Oven Furnace.

With this new gas-fired oven furnace, the desired temperatures are reached in a much shorter period of time, and the fuel consumption has been reduced. These factors have contributed greatly to direct dollar savings reflected in increased production, elimination of rejects, and in general over-all improvement in heat treating operations.

For example, the new furnace has almost eliminated surface decarburization and greatly improved product uniformity in the heat treatment of railroad car and locomotive springs, frog and railroad crossing bolts, and track tools.



The heat treating cycles for these springs are as follows:

Material: AISI Grade 8650 Alloy Steel.

Sizes and Weights: Variable.

Forming: Heat spring leaves uniformly to 1600°F; form at this temperature and let cool to black heat at room temperature.

Quenching: Reheat the spring leaves uniformly to 1620°F, soak at this heat for 10 minutes, then quench in warm oil.

Tempering: Draw the leaves by heating in salt bath at 850°F for two hours. Remove from salt and let cool in air.

Frog bolts make up another large percentage of the items heat treated in the oven furnace. This heat treat cycle is as follows:

Material: Grade 8620 Steel.

Sizes: ⅞" to 1⅜" diameter, various lengths.

Weight: Variable.

Normalizing: Normalize at 1650°F for 45 minutes. Remove from furnace and let cool at room temperature.

Reheating: Reheat to 1550°F. Hold for 20 minutes, quench in water. Bolts to be quenched singly in circulating water.

Drawing: Draw in salt bath at 850°F for two hours. Remove from salt and let cool in air.

This furnace is gas-fired with a series of special nozzle-mixing burners firing from both sides beneath the hearth. Products of combustion are forced upward, over and around the work, and are then exhausted through vents located in the furnace arch. This design assures the closest possible temperature uniformity.

Combustion equipment consists of eight Sunbeam nozzle-mix burn-

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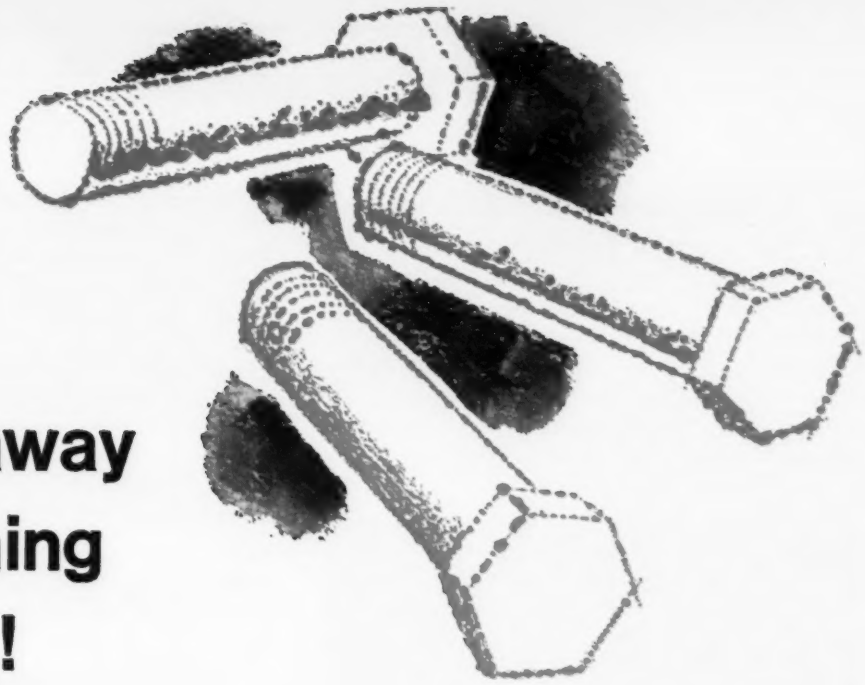

Don't throw away quenching rejects!

A recent job order for 45,000 automotive head bolts resulted in variable core hardness after quenching. Recharging the system with Sinclair Quenchol® 521 brought the bolts to uniform hardness of 52-54 Rc—and the 45,000 bolts were saved! Quenchol oils have earned the reputation for long service life, too—a further saving. Next time management asks you how you've cut costs, tell them you've switched to Sinclair—and show them far superior results in quenching.

Call your **Sinclair Representative** for further information, or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.

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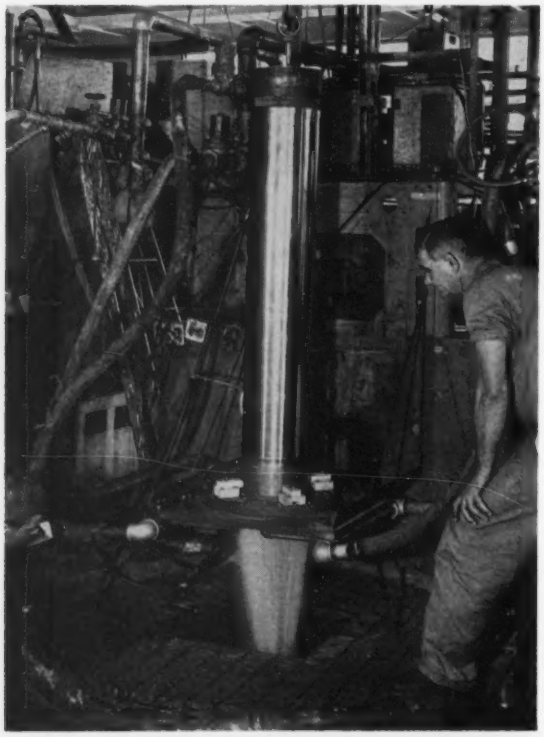
ABSTRACTS

Induction Hardening of Ductile Iron Cylinders

Aetna-Standard Engineering Company has announced shipment of a guide and tension unit equipped with ductile iron rolls to Crucible Steel Company of America.

The unit will be used in a continuous annealing and pickling line for stainless steel strip. It provides back resistance so that the strip will not buckle or whip as it is fed into the annealing furnace.



Ductile iron roll being induction hardened in a specially-built device. Roll is lowered through induction coil, then through a heavy water spray immediately below.

Induction hardened ductile iron rolls will provide a better combination of strength, wear resistance and non-scoring properties than either steel or cast iron. Ductile iron can be surface hardened by either induction or flame heating, thus rendering it more resistant to metal-to-metal wear. The presence of graphitic carbon in the hardened ductile iron allows the roll surfaces to retain a good finish, thereby reducing damage to the strip.

The guide and tension unit calls for five of these rolls. The top two rolls are set in anti-friction bearings in adjustable take-up units. Spring pressure forces these two rolls down on the strip as it feeds across the top of the bottom three rolls. The pressure is adjustable to make allowance for differences in thickness.

Aetna-Standard designed and cast the rolls for the unit. After casting and finish machining, the rolls were normalized and tempered. The ductile iron cylinders were 10" in diameter with a 1¾" wall x 60" long. They were of the following analysis:

TC	SI	Mn	P	Ni
3.50	2.50	.20	.048	.45

They were normalized from 1650°F and tempered at 1150°F for six hours with the resulting hardness of 225 Brinell. A subsequent Rockwell "C" hardness test on a cylinder converted to 235 Brinell.

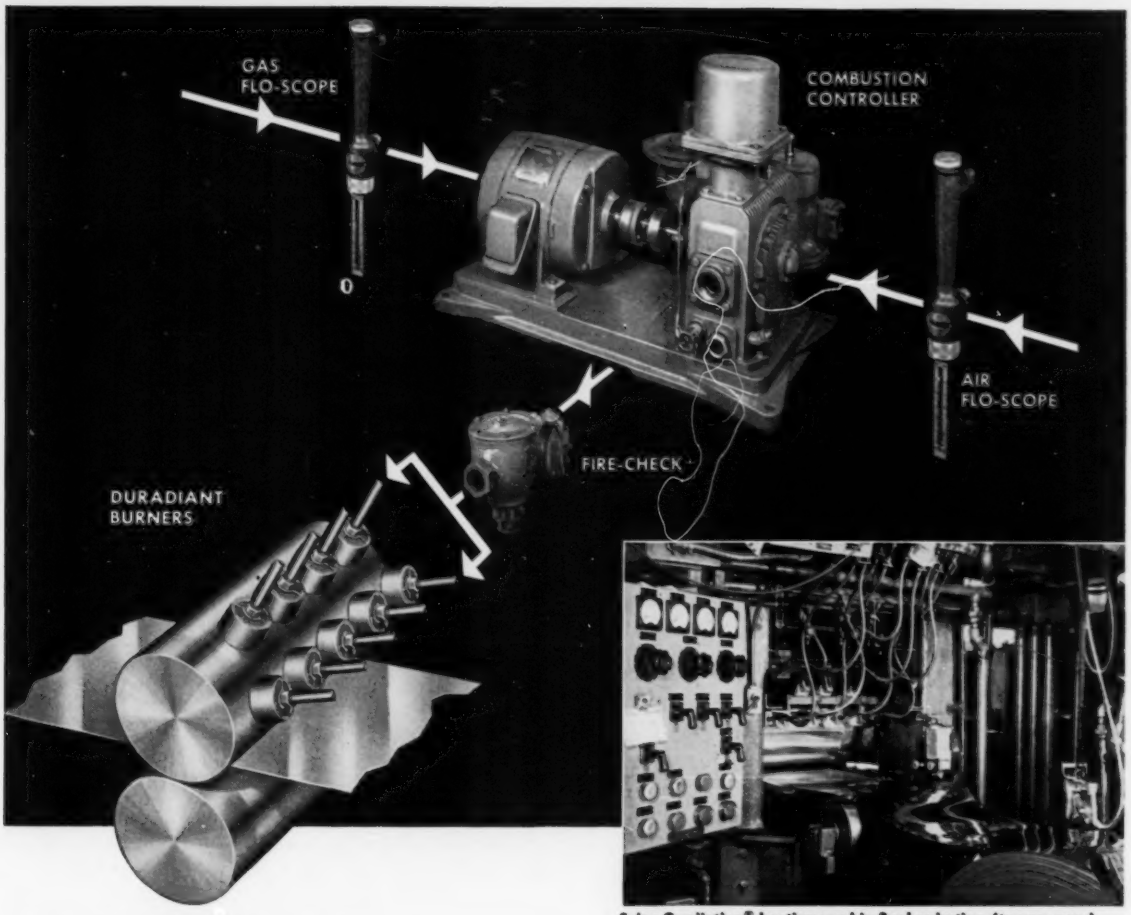
A test cylinder was first induction hardened on the middle and at each end. It was then sectioned and examined. No cracking occurred, and the hardness penetration was as follows:

Surface	60 Rc
1/16"	58, 54, 56 Rc
1/8"	56 Rc
5/32"	56 Rc
7/32"	46 Rc
1/4"	35 Rc
9/32"	35 Rc
5/16"	27 Rc
3/8"	20 Rc

The cylinder was lowered continuously through an induction coil and drenched with a heavy water spray immediately after heating (see photo). The induction hardening was done at 9600 cycles and about 170 kilowatts. The cylinder traveled through the coil at the rate of about 14 seconds per inch, or in other words, about 15 minutes were required to harden the entire 60" long cylinder. No preheating was used, and after hardening, cylinders were to be drawn at 350°F.

Aetna-Standard is currently producing about two heats a week of ductile iron castings other than rolls. Most of these are for their own work. It is common practice to normalize grooved ductile iron rolls after machining in order to get higher hardness and deeper penetration into the grooves. This normalizing treatment also gives more resistance to breakage. Their highest alloy ductile iron roll contains 3.50% carbon, 3.50% nickel, and .60% chromium. The hardest ductile iron roll produced was 75 Shore, and they have only made a few of these.

Source—INCO NICKEL TOPICS, vol. 11, no. 3



Selas Gradiation® heating used in final reduction (temper pass) permits quick correction of steel strip gage. Nine Duradiant burners are strategically located across face of top work-roll approximately 3 to 4 in. from surface. Individual burners are ignited as required; come to high heat instantaneously.

Split-second Response of Selas Duradiant® Burners Helps Maintain Uniform Gage of Steel Strip

Alan Wood Steel Company uses this unique application of Selas radiant heating to control gage of steel strip in a cold rolling operation.

Heat is applied accurately *where required* across face of top work-roll to locally expand the roll, assuring constant thickness of the steel strip: actually controlling its gage within ±0.0002 inch.

The Duradiant burners ignite and come to heat instantaneously to effect these quick changes in roll contour. Strip emerges wrinkle-free. Because Duradiant burners heat without flame impingement, the problem of soot deposit on the roll — and subsequent transference to strip — has been eliminated.

Throughout the steel industry, to provide most efficient operation of Duradiant burners, Selas offers a complete combustion package:

- Combustion Controller — makes possible fast heating and close control, by delivering gas-air mixture to burners at preset ratio and pressure. Completely automatic; no labor required in its operation. Factory Mutual approved.
- Flo-Scopes®— installed at the inlets to the Combustion Controller, Flo-Scopes measure rates of flow of gas and air and permit accurate determination of gas-air mixture ratios.
- Fire-Check — gives complete assurance of safety by automatically extinguishing any flashbacks that may occur. Factory Mutual approved.

Standard Duradiant burners can be utilized in open arrangements . . . in-line . . . in circular rings . . . in spirals . . . individually . . . in opposed pairs. Special Duradiant designs can be custom-built to meet your specific needs.

Selas also offers other types of burners including Superheat, Refrak, Spear-Flame and Ribbon.

These combustion components are available individually or as a complete combustion package.

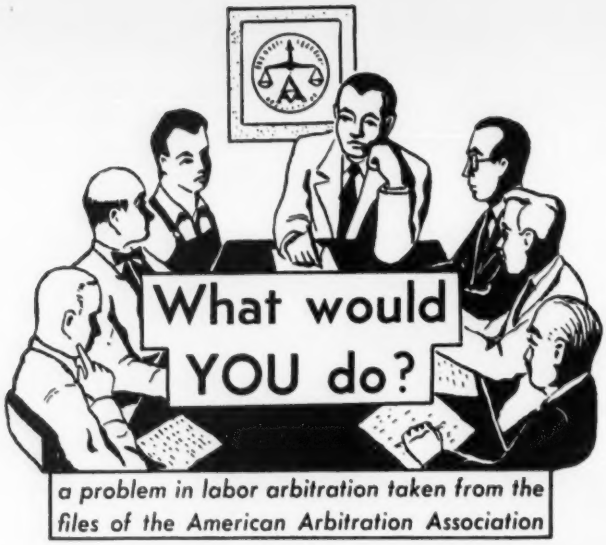
For descriptive literature on any of the above combustion components, write Dept. 65, Selas Corporation of America, Dresher, Pa.

Gradiation, Duradiant and Flo-Scope are registered trade names of Selas Corporation of America.

SELAS
CORPORATION OF AMERICA
DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers

DEVELOPMENT • DESIGN • CONSTRUCTION



a problem in labor arbitration taken from the files of the American Arbitration Association

The Case of the Compensable Injury

When management of a furniture company and a union negotiated a collective bargaining contract, they agreed that the amount of vacation pay a worker could draw would be based upon the number of hours he worked during the two weeks immediately preceding the vacation period. As a further safeguard, they provided that time lost because of "compensable injury" was to be counted as time worked for the purpose of computing the number of hours a man had worked during those weeks.

This seemed clear enough until the first occasion arose when that provision had to be applied. One week before his vacation, Edward S. tripped over a skid and injured his chest and shoulders. He was treated by a Workmen's Compensation doctor and paid for the day the accident occurred, but he lost a full day before he was able to work again. Management figured Ed had worked only 32 hours in the week preceding the vacation and made up his vacation check accordingly. But the union filed a grievance.

"That was a compensable injury and Ed is entitled to a full week's vacation pay," argued the union steward.

"Not so," answered the company. "That injury didn't last long enough to be compensable under our state compensation laws. We don't have to count that lost day as time worked for vacation purposes."

Eventually the case went to arbitration under the rules of the American Arbitration Association.

What Would YOU Do?

THE AWARD: The arbitrator said "compensable injury" referred to the manner in which the injury occurred, not just to whether it was of sufficient duration to result in payments by the state. Furthermore, he said, medical treatment is also a form of compensation. Ed got his vacation pay computed over again to include the lost day.

The Case of the Eliminated Job

Frank J. was classified as an assistant chemical operator and, for several years, was assigned to a centrifuge machine in the company's laboratory. One day toward the end of 1958, after a re-examination of all operations, management decided to abolish that operation. They posted a notice declaring Frank's job vacant and transferred him to another spot, at the same rate of pay and within the duties of an assistant operator.

But Frank wasn't satisfied. He had his eye on a "filtration operator" job in another department which was held by a man he outranked in seniority. "I wouldn't try to bump another man out of a job under other circumstances," he explained, "but when my job is declared vacant, I've got the right to look around for something else and put in a bid for the best job available."

The company saw it in a different light. "You didn't bid for the filtration job when it was open a while back. It's not available to you any more."

The case wasn't settled in grievance procedure and eventually went to arbitration under the rules of the American Arbitration Association.

What Would YOU Do?

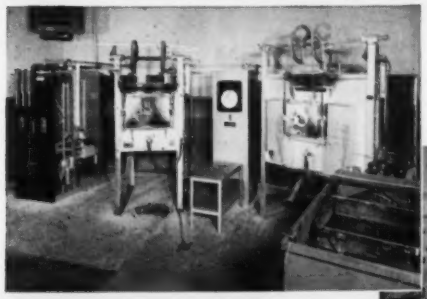
THE AWARD: The arbitrator said the essential fact was that Frank's specific job was eliminated, not his job classification. As long as there was work for him as an assistant operator at his regular rate, he couldn't bump anyone else off a job. To rule otherwise, he said, "would be tantamount to nullifying the bidding system . . . by permitting 'bumping' upward even after jobs had been filled by successful bidders — unchallenged by the 'bumper'."

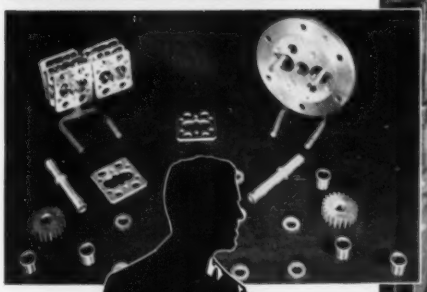
CAUTION: The award in these cases is not an indication of how other arbitrators might rule in other apparently similar cases. Arbitrators do not follow precedents. Each case is decided on the basis of the particular history, contract, testimony and other facts involved. • • •

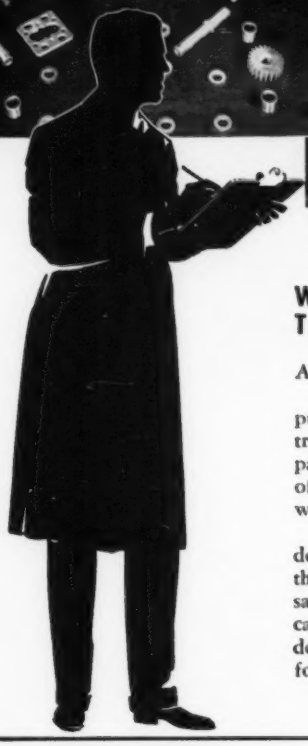
Automatic Atmosphere Control assures *"on the button"*

HARDENING OF HIGH SPEED STEEL

according to Metallurgist Al Aldrich, W. H. Nichols Co., Waltham, Mass.







HERE'S WHY...

W. H. NICHOLS COMPANY CHOSE HAYES EQUIPMENT TO HEAT TREAT CLOSE TOLERANCE PUMP PARTS . . .

AL ALDRICH *testifies:*

"To meet the exacting performance demands required of our nylon and rayon pumps, we chose Hayes equipment to give us the precision control so vital in heat treating the high speed steel, the high carbon-high chrome steel, and stainless steel parts involved. Customized procedures established in the Hayes laboratory assure us of full hardness, minimum distortion, and absence of scale. Our grinding operation was greatly reduced and product uniformity is consistently uniform day after day.

"A Hayes Endothermic Generator (push-button controlled) produces a predetermined atmosphere (by adjusting mixer for a given gas-air ratio) which enters the Hayes Preheat and High Heat Furnaces. A Foxboro Dewpoint Controller samples the atmosphere (in high heat furnace) and automatically enriches the carrier gas to maintain the proper dewpoint for the steel being treated. The recorded dewpoint visually tells our heat treater when the furnace is properly conditioned for the steel to be processed."

Savings thru Quality . . . Greater user savings are warranted since only the highest quality refractory linings are used in Hayes heat treating equipment . . . resulting in much longer life and less maintenance.

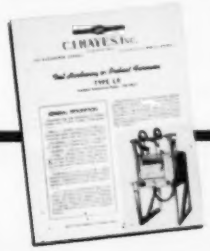
YOU TOO... can be assured of GUARANTEED RESULTS designed to improve your product, increase output, and reduce unit costs. Let us show you what over fifty years experience in developing the well known line of CERTAIN CURTAIN electric furnaces and allied equipment can do for you. Write today!

C. I. HAYES, INC.

Established 1905

816 Wellington Avenue · Cranston 10, R. I.

ELECTRIC CERTAIN CURTAIN FURNACES



Write today for Bulletin 461, describing Hayes Preheat and High Heat Furnaces.

M.T.I. *Activities*

FLORIDA SPRING MEETING

The 1959 Spring Meeting of the MTI was held April 22-24 at the Hollywood Beach Hotel and Club, Hollywood, Florida. The attendance was excellent with over 80 people participating, including members and their wives and children.

The program began informally with a "Get-together" Breakfast, and then the official meeting started with a technical session featuring a panel discussion moderated by two members: William E. Engelhard of Owego Heat Treat, Inc., was discussion leader on the subject "New Developments in Quenching"; and Michael Kober of Commercial Metal Treating, Inc. led the discussion on "Customer Goods Insurance."

A Deep Sea Fishing Tournament was held in the afternoon, and the winner of the prize for the outstanding catch of the day was A. L. De Hart of Fred A. Snow Company, Chicago, Illinois.

Two outstanding speakers were featured at the other technical sessions. Mr. E. N. Case, of the Ajax Electric Company, Philadelphia, Pa., presented an illustrated paper entitled "The Prediction of Carburizing Cycles." Mr. Edward Wimmer, Vice President of the National Federation of Independent Business, Inc., Cincinnati, Ohio, discussed current vital economic problems under the subject of "Centralism—Road to Socialism."

A few of the facts and ideas presented by Mr. Wimmer are quoted below:

"Can we lose the cold war to the Communists on the economic front, is the biggest question now facing every thinking American, and that question is not being answered in a spirit of confidence by our national leaders. In fact, there is an underlying fear that our private, capitalistic, free enterprise system is incapable of providing both freedom AND security, which fears must be dispelled if anything resembling free enterprise and representative government is to prevail.

"Most of our educators see no real future for American youth in pursuits that call for individual initiative and individual enterprise. They are convinced that more and more government-made security will be necessary and, like most of our youth (and a majority of our citizens), they are prepared to trade independence for a government guarantee.

"Unless the attitude of youth, and those who are teaching them and shaping their philosophy, is changed, American business is destined for the straitjacket of socialism preceded possibly by some type of corporate fascism—manipulated by those in control of what could be aptly described as monster business, monster unions, and monster government.

"The only way out is a revolutionary program of decentralization designed to 'unscramble' all giant corporations put together in violation of the spirit and intent of the antitrust laws; moving swiftly toward a similar unscrambling of the giant labor unions.

"An overhauling of the whole tax structure with a view to making whatever changes that are necessary to encourage proprietorship and to discourage mergers, is long past due. Under our present tax laws, smaller businesses find it more profitable to sell out. Inheritance taxes as constituted are destructive to the small and medium size companies; depreciation allowances are too low to encourage modernization, and

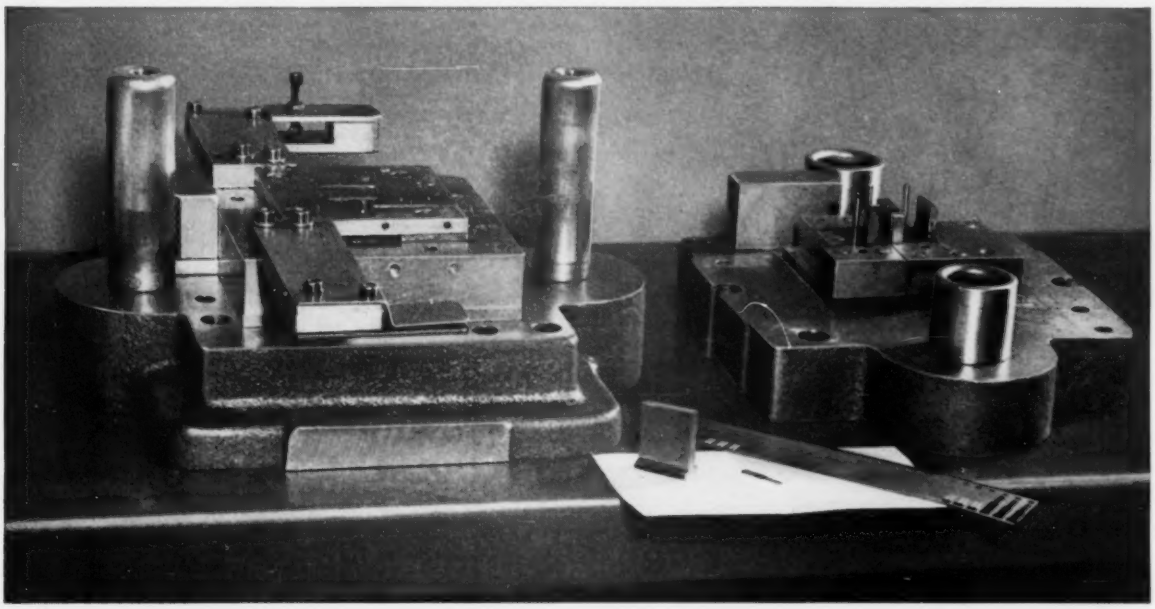
(Continued on page 45)

Members who attended a recent meeting of the Texas Chapter of the Metal Treating Institute held at the Houston Engineering & Scientific Society in Houston, Texas: (from left to right) Edward F. Moore, Houston Heat Treating Co.; Charles Dominy, Superior Heat Treating Co.; Leon Sanders, United Heat Treating Co.; Boyd Dominy, Dominy Heat Treating Co.; L. J. Van Dorfy and Kenneth Ward, Lone Star Heat Treating Co.; Cliff Cook, Cook Heat Treating Co.; and C. E. Herington, Executive Secretary of the MTI.

Tool Steel Topics

BETHLEHEM STEEL

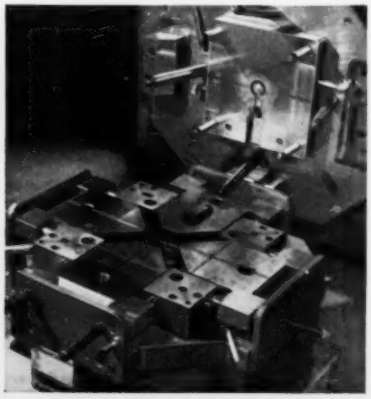
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



Blanking Die Output Doubles When Bearcat Takes Over

At the Remington Rand Division of Sperry Rand Corp. they were getting up to 50,000 pieces from a set of dies that blanks and forms grooved pins from .025-in. steel strip. Our local tool steel distributor, Leed Steel Co., suggested a change to our Bearcat tool steel. Result? The output increased to about 100,000 before the die needed reworking.

Bearcat has exceptional resistance to wear and shock. Because of its air-hardening characteristic, Bearcat minimizes quenching hazards and distortion in heat-treatment.



WIDE RANGE OF APPLICATIONS

In addition to blanking and forming jobs, Bearcat can be used economically in such varied applications as shear blades, punches, rivet sets, hot headers, die-casting die inserts, and master hobs. In fact, wherever the job calls for a grade having unusual toughness, Bearcat is the answer.

Your Bethlehem tool steel distributor carries Bearcat in stock in a wide size range. He's ready to serve you at a moment's notice. Give him a call today.

←Memo to Die-Casters:

USE CROMO-HIGH V (H-13)

You can't go wrong when you choose Bethlehem Cromo-High V (AISI-SAE H-13) for die-casting. This 5 pct chromemoly grade, with 1 pct vanadium, has good resistance to wash and erosion, plus plenty of toughness. It's uniformly annealed, for easy machinability. It also has good center density and grain refinement, and is free from porosity.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Periodic Regrinding Improves Tool Life

The service life of many types of tools can be improved if the tools are periodically reground at intervals before they have deteriorated to a degree which impairs their function.

This practice is particularly useful when applied to tools which repeatedly fail in service by fatigue, chipping, spalling, or cracking through heat checks. The objective of preventative grinding is the removal of service-damaged metal before the damage progresses to a depth which would not be removed in normal redressing operations. It is an application of the old proverb, "A stitch in time saves nine," and is just as appropriate when applied to tools as to a small rip in a piece of wearing apparel.

The point at which regrinding should be done during the service of a given tool must be developed by experimental work. It is most practical if it can be made to coincide with a normal shutdown of an operation for other reasons.

YOU CAN FIND BOTH THE BIGGEST AND THE BEST AT YOUR COMMERCIAL HEAT TREATER

A new gas fired Homocarb said to be the world's largest.

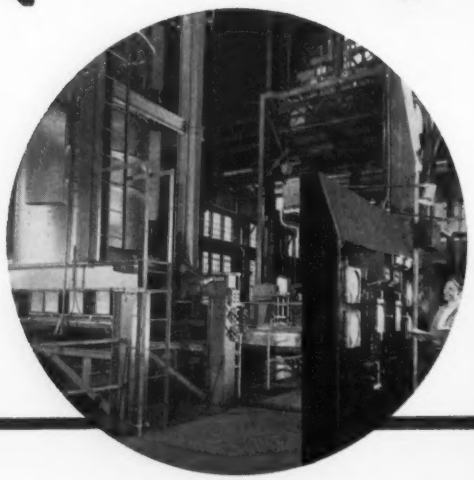
THE THREE FURNACES shown on this page are units of the facilities of three commercial heat treating plants in different sections of the country.

Today, with the ever growing demand for *better* heat treating, economical volume equipment of this sort is becoming essential and the commercial heat treater has been alert to industry's requirements.

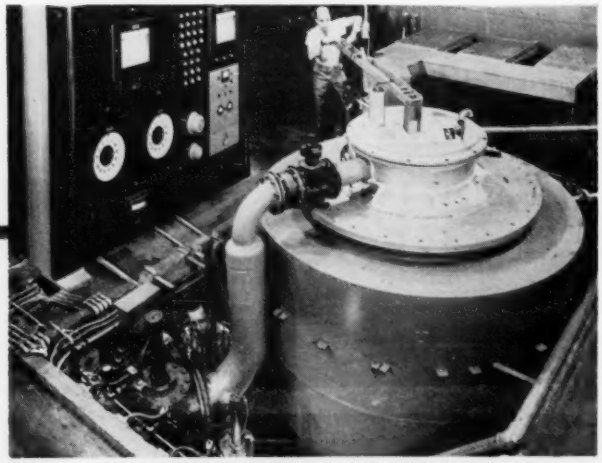
Quality work and versatility are the keynotes of this industry's objectives when treating the thousands of vital, intricate, and costly components of important products.

Whatever your heat treating problem, and whether it involves pounds or tons, always consult your *commercial* plant first.

Write for the folder
"HEAT TREATERS CITE SHORT CUTS TO MORE EFFECTIVE PURCHASING."



Large capacity vertical furnace for heat treating large parts.



A Vacuum Heat Treating Furnace for special materials.

THERE'S A HEAT TREATING SPECIALIST NEAR YOUR PLANT

ALABAMA

Southern Metal Treating Co., Inc.
3131 10th Ave. N., Birmingham 4

CALIFORNIA

Certified Steel Treating Co.
2454 E. 58th St., Los Angeles 58
Hollywood Heat Treating Co.
1041 N. Mansfield Ave., Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Cook Induction Heating Co.
4925 East Slauson Ave., Maywood

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
2[illegible] Homestead Ave., Hartford 12
Ireland Heat Treating Co.
512 Boston Post Road, Orange

ILLINOIS

Senecca Heat Treating Co.
124 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Allied Metal Treating Corp. of Illinois
333 N. California Ave., Chicago 12
Dura-Hard Steel Treating Co.
2112 W. Rice Street, Chicago 22
Perfection Tool & Metal Heat Treating Co.
1756 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kinzie St., Chicago 22
American Steel Treating Co.
P. O. Box 396, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Rockford
Lindberg Steel Treating Co.
1975 N. Ruby St., Melrose Park
Ipsenlab of Rockford, Inc.
2125 Kishwaukee Street, Rockford
O. T. Muehlemeyer Heat Treating Co.
1500 Preston St., Rockford
Scott & Son, Inc.
1510 First Ave., Rock Island

INDIANA

Quality Steel Treating Company
1630 Locust Street, Anderson

MASSACHUSETTS

Kinetics Corporation
2 Churchill Road, Hingham
New England Metallurgical Corp.
475 Dorchester Ave., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Springfield Heat Treating Corp.
99 Margaret Street, Springfield
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
1033 Mt. Elliot Ave., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Standard Steel Treating Co.
3467 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit 7
State Heat Treat, Inc.
520 32nd Street, S. E., Grand Rapids 8
Lincoln Heat Treat, Inc.
21235 John R, Hazel Park
Royal Oak Heat Treat, Inc.
21419 Dequindre, Hazel Park
American Metal Processing Co.
12000 East Nine Mile Road, Warren

MINNESOTA

Metallurgical, Inc.
900 East Hennepin, Minneapolis 14

MISSOURI

Metallurgical, Inc.
1727 Manchester Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Metal Treating Corp.
611 Grove St., Elizabeth 2
American Metal Treatment Co.
Spring and Lafayette Sts., Elizabeth
Benedict-Miller, Inc.
Marin Ave. & Orient Way, Lyndhurst
Bennett Heat Treating Co., Inc.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark 5
Temperature Processing Co., Inc.
228 River Road, North Arlington

NEW YORK

Owego Heat Treat, Inc.
Rural Route 1, Apalachin
Fred Heinzelman & Sons, Inc.
138 Spring St., New York 12
Alfred Heller Heat Treating Co., Inc.
391 Pearl St., New York 38
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Rochester Steel Treating Works
962 Main Street, E. Rochester 5
General Heat Treating Corporation
206 Sand Street, Syracuse 3
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 11
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1273 East 55th Street, Cleveland 3
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 Lake Road, Cleveland 16
Dayton Forging & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Drever Company
Red Lion Rd. & Philmont Ave.,
Bethayres
Robert Wooler
Dresher
J. W. Rex Co.
834 West 3rd St., Lansdale
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 E. Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
Gulph Road, King of Prussia
Pittsburgh Commercial Heat Treating Co.
49th St., and A.V.R.R., Pittsburgh 1
Pittsburgh Metal Processing Co., Inc.
1850 Chapman Street, Pittsburgh 15

TEXAS

Dominy Heat Treating Corp.
P. O. Box 5054, Dallas
Superior Heat Treating Co., Inc.
P. O. Box 69, Fort Worth 1
United Heat Treating Company
2005 Montgomery Street, Fort Worth 7
Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11
Houston Heat Treating Company, Inc.
2100 Quitman Street, Houston 26
Lone Star Heat Treating Corp.
5212 Clinton Dr., Houston 20

WISCONSIN

Allied Metal Treating Corp.
P.O. Box 612, Milwaukee 1
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wisconsin Steel Treating & Blasting Co.
1114 South 41st Street, Milwaukee 15
Harris Metals Treating Co.
4100 Douglas Ave., Racine

CANADA

Ipsenlab of Canada Limited
27 Bermondsey Road, Toronto 16, Ont.

All of the above listed firms are members of the

METAL TREATING INSTITUTE

271 North Avenue, New Rochelle, N. Y.

MTI MASTER CRAFTSMEN METAL TREATING INSTITUTE

NEWS TO HEAT TREATERS

(Continued from page 14)

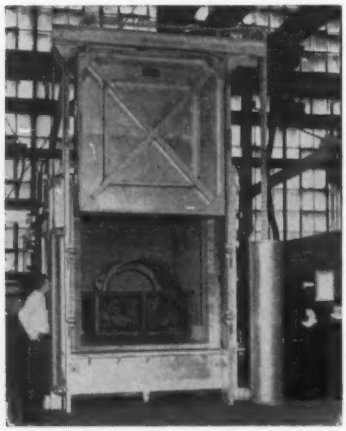
INDUSTRIAL FURNACE STATISTICS

Net new orders for industrial furnaces in March 1959 of $6,146-000 were up 125% from February volume of $2,741,000. Total net orders in the first quarter 1959 amounted to $12,406,000, or up 29% as compared to first quarter 1958 volume of $9,603,000.

March 1959 net orders for induction heating equipment of $731,-000 was down 36% from the month earlier volume of $1,147,000. First quarter 1959 new orders totaled $2,882,000 as compared to $1,377,-000 for the same 1958 period, a rise of 110%. These figures were released by the Industrial Heating Equipment Association, Inc., in Washington, D.C.

FLEXIBLE HEAT TREAT FURNACE

Largest furnace ever shipped as a packaged unit by Surface Combustion Corporation, adds flexibility to the heat treating operations of a leading manufacturer of electric motors and controls. This large oven furnace eliminates production problems by performing many different heat treat cycles and accommodat-



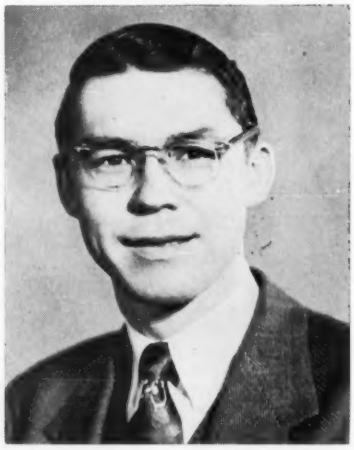
ing a variety of part sizes to be heat treated. Operating range of the furnace is 600°-2000°F. Large weldments, forgings, castings and shafts 63" long handled in an upright position are easily processed in this furnace, which heat treats 7500 pound work loads.

For further information circle No. 5

NEW SALES MANAGER

Appointment of Rolland S. Jamison as Sales Manager of Harris Refrigeration Co., Cambridge, Mass., was announced by Charles C. E. Harris, President of the Company. Mr. Jamison has been administering a national marketing program for Harris low-temperature refrigeration equipment for environmental testing, industrial processing and storage for the past two years in Cincinnati.

"We are apparently only on the threshold of the rapidly expanding applications of low-temperature equipment for stabilizing metal structures, controlling ductility, and assuring maintenance of strength properties at high-temperature operation, as in missiles and rockets," stated Mr. Harris.

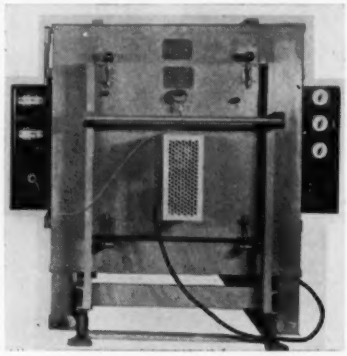


Prior to his association with Harris, Mr. Jamison was head of product development and service for the Cincinnati Sub-Zero Products Co., where he was Assistant to the President. Nationally recognized as an authority on low-temperature refrigeration, he delivered a paper in 1954 at the 22nd Annual Meeting of the American Society of Tool Engineers. The processes which he outlined in this paper have found wide application and are being used nationally by industry today.

For further information circle No. 6

CONTROLLED RETORT OVEN

Grieve-Hendry Co., Inc., announces availability of an electrically-heated controlled atmosphere retort oven for annealing brass or other metallic parts. Clear inside working space of the retort is 24" wide, 24" high and 18" deep, and the maximum continuous working temperature is 1100°F.

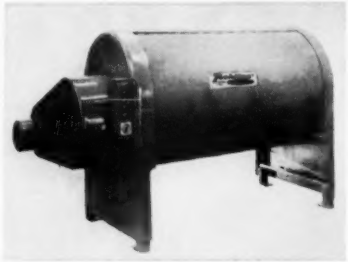


Two retorts are furnished with the oven, allowing controlled cooling of one batch while another batch is being annealed. The retorts, equipped with casters, slide into the radiant furnace on channel tracks and lock into an air-tight fit within the furnace. Accurate temperature is maintained by two electronic proportioning temperature controllers.

For further information circle No. 7

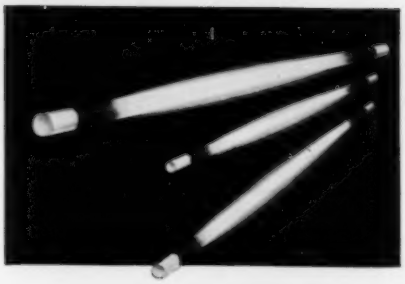
BARREL FINISHING EQUIPMENT

A new line of precision barrel finishing equipment known as the Model 30 series manufactured by the Techline Division of Wheelabrator Corporation, Vicksburg, Michigan, is now available. The equipment is reported to be so stable that a coin balanced on edge on the housing will remain standing throughout the entire operating cycle.



Other features of the series equipment include: Molded fiber-

(Continued on page 32)

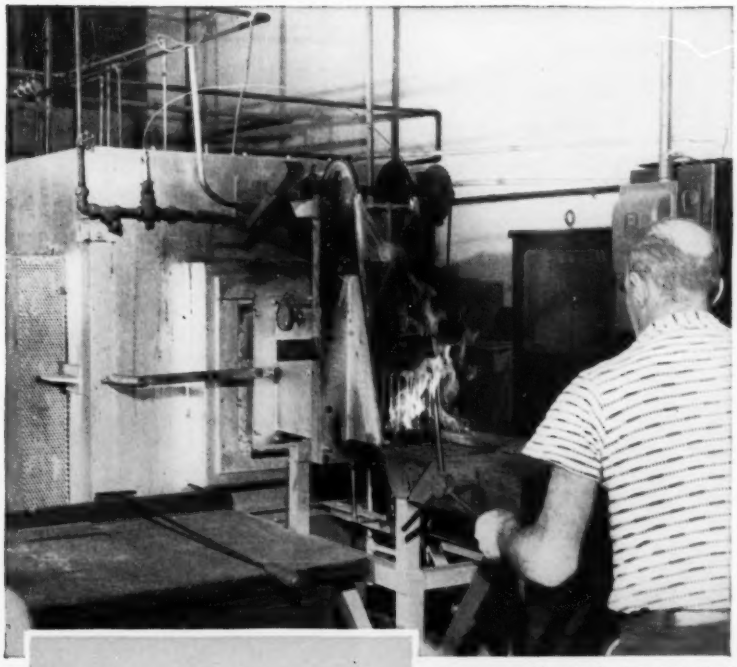


Norton CRYSTOLON Heating Elements or "HOT RODS" are a typical Norton R_x — an expertly engineered product prescription for greater efficiency and economy in electric furnace and kiln operations. These one-piece rods, made of self-bonded silicon carbide, have a central hot zone and cold ends. Aluminum-sprayed tips and metal-impregnated ends minimize resistance and power loss. Available in all standard sizes.

Leading manufacturer of masonry bits

Gets twice as much life — and more!

... from Norton "HOT RODS"



Operator at New England Carbide Tool Company, Medford, Mass. loads masonry bits into C. I. Hayes Electric Furnace which brazes carbide tips to the shanks of the bits. Norton "HOT RODS" are used exclusively in this furnace because of their longer life and constant heat control characteristics.

Continuous operation in a hydrogen atmosphere at 2250°F is a tough assignment for *any* electric furnace heating element. But Norton CRYSTOLON* Heating Elements ("Hot Rods") take it in stride at New England Carbide Tool Company, world's only manufacturer of a complete line of carbide-tipped masonry bits.

In fact, the company has proved by actual performance that Norton "HOT RODS" last more than twice as long as any other type of non-metallic heating element. What's more, they find that Norton "HOT RODS" make possible smoother, more economical control of power to the furnace during this critical brazing operation.

Norton "HOT RODS" are outlasting other heating elements of the same type in plants everywhere . . . providing better control of heat . . . protecting quality at critical stages of production . . . keeping element costs and maintenance at a new low.

Put Norton "HOT RODS" to work in your heat treating and metalworking operations. They're available in lengths from 6 inches to 8 feet to meet a wide variety of heating requirements efficiently and economically. Get complete details. Send for "Norton Heating Elements". NORTON COMPANY, Refractories Division, 624 New Bond Street, Worcester 6, Mass.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
REFRACTORIES
Engineered... R_x ...Prescribed

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

NEWS TO HEAT TREATERS

(Continued from page 30)

glass safety gate which is corrosion-proof and lightweight for easy operation; full-opening doors on the cylinder for greater convenience in loading, unloading and cleaning the cylinder; doors "super-sealed" by special cam locks which operate on only 90° of turn, exerting high-compression pressure on the Neoprene door seals.

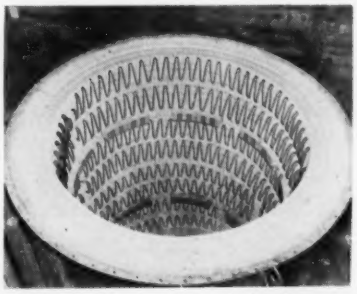
Power transmission is by an exclusive V-belt drive which is noiseless, reduces maintenance problems and reportedly wears longer than a chain-and-sprocket drive. The Techline equipment also features safety controls to prevent the machine from operating with the gate open except for "jogging" and an attractive fiberglass housing which guards the entire drive mechanism.

The standard barrel finishing machines are offered in 20 models ranging from 5 to 30 cu. ft. capacity, and having one to six separate compartments, designed for both wet and dry processes.

For further information circle No. 8

INSULATING FIRE BRICK

Insulating refractories are important in Lindberg Steel Treating Company's new gantry-type controlled atmosphere hardening furnace with atmosphere quench for hardening rocket motor cases and aircraft components.



The work chamber of the furnace is lined with a high quality lightweight insulating refractory by Armstrong Cork Company, Lancaster, Pa., and backed by courses of medium and low temperature insulating slabs.

The insulating fire brick helps keep temperatures constant by re-

ducing heat loss. Type A-25 was selected for this job; it has a maximum hot face temperature of 2500°F and a modulus of rupture of 110 lbs. per square inch and compressive strength of 225 lbs. per square inch. The pyrometer cone equivalent is 29; the corresponding softening point 3018°F.

Close control of combustion when the bricks are fired eliminates internal strains and lends uniformity. The resulting high strength lengthens brick life.

For further information circle No. 9

NON-SCALING COMPOUND

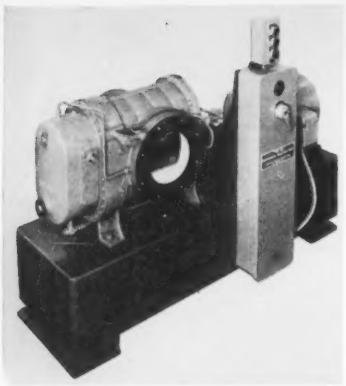
The Parker-Hartford Corporation of Hartford, Conn., has announced a new name for one of its products in its line of non-scaling compounds. Formerly known as "Phoenix Brand Non-Scaling Compound," it is now simply "PBC."

This compound is said to be an excellent protection for steels heat treated up to temperatures of 1650° F, or for annealing. It is available in 2, 5, and 15-lb. cans as well as a new 25-lb. fibre drum.

For further information circle No. 10

HIGH VACUUM MECHANICAL BOOSTER PUMPS

General Vacuum Corporation has introduced a new series of Mechanical Booster Pumps in standard sizes from 230 to 12,000 cubic feet per minute. These lobe-type pumps have high pumping speeds over the wide range of 1 micron to 10 millimeters of mercury absolute suction pressure. They are available as



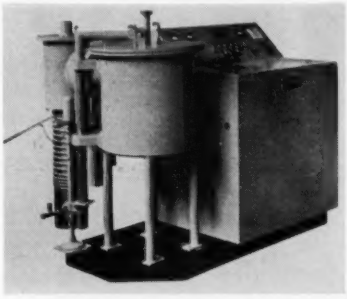
single-stage boosters for applications in high vacuum pumping systems wherever their unusual pumping characteristics and reliable, low-maintenance operation are needed.

Mechanical booster pumps are used in many new high-vacuum pumping systems, and also to supplement existing systems for: rapid pump-down of simulated altitude chambers; high vacuum impregnation and drying; arc furnace pumps where outgassing loads occur in 1 micron - 10 millimeter range; vacuum processes where backstreaming must be eliminated; extending the useful range of conventional vacuum pumps such as water and oil-sealed units and steam jets; replacement of oil type diffusion pumps with elimination of accompanying manifolding, valves, and maintenance.

For further information circle No. 11

VACUUM HEAT TREATING FURNACE

The F. J. Stoke Corporation has developed a cold-wall resistance-heated vacuum furnace which is capable of operating at temperatures up to 2200 deg. C. (4000 deg. F.). The unit is suitable for sintering powder metal parts compacted of materials with a very high melting point, such as tantalum, or for degassing components such as tungsten elements for electronic tubes, which require equally high temperatures, as well as for other heat-treating operations, either in experimental work or small scale production.



The photo shows that the furnace is a compact unit, of approximately desk-top height, 5 ft. 4 in. long and 4½ ft. wide. Within the vacuum retort, which is 20 in. in diameter and 20 in. deep, is a hot zone 3½ in. in diameter and 6½ in. deep, produced by a resistance-heated radiant cylinder. This hot zone is surrounded by a water-jacket. Hot zones of varying sizes can be interchanged within the retort, to handle work pieces of different dimensions and types.

For further information circle No. 12

FAST-CYCLING TEMPERING FURNACE

A new general-purpose furnace designed for a wide range of tempering and drawing jobs requiring

(Continued on page 36)

From left to right, Mr. Karl Woerle, Foreman, Mr. Neil Paterson, Supervisor of Tools and Equipment, Mr. Robert Settles, Park Chemical Company Representative.

Hamilton Standard gets better results from Park Aluminum Brazing Salt

In many cases, dip brazing in salt baths is the most practical method of joining aluminum. Extremely thin gage aluminum can be handled without damage from pitting or distortion because of uniform heating, close temperature control and the buoyancy of the molten bath. Salt brazing is often the only way complicated assemblies such as heat exchangers can be brazed successfully.

Park Aluminum Brazing Salts are superior to other fluxes because of their better fluidity, greater stability, freedom from sludge and ease of cleaning. They act as both flux and heat transfer medium for all dip brazing operations on aluminum alloys. Joints can be made by using wire rings, flat shims or brazing sheet. Assemblies of various sizes and shapes can be brazed at the same time, saving time and labor.

Hamilton Standard's work includes a variety of aircraft parts requiring a high quality bond. It is important that an aluminum brazing salt be used that meets their high standards of quality. Park Aluminum Brazing Salt D has produced quality brazing efficiently and economically for Hamilton Standard. Separate additions of costly chlorides have been eliminated. Laboratory and maintenance control has been reduced to a minimum. The problem of desludging three times a week has been reduced to checking for sludge once a week. The stability and reliability of Park Aluminum Brazing Salt has been amply demonstrated.

For detailed information on Park Aluminum Brazing Salts and their applications, send for technical bulletins or contact your nearest Park representative.

Park

PARK CHEMICAL COMPANY • **8074 Military Avenue, Detroit 4, Michigan**

NEWS TO HEAT TREATERS

(Continued from page 34)

close temperature control is now being offered by C. I. Hayes, Inc.

The new unit, the Type D Flexotemp (TM) Furnace, is said to reach any desired temperature in minutes. Another feature is that accurate temperature uniformity within ±5° F is maintained during the treatment cycle. The furnace comes complete with proportional heat control which provides maximum power during heat-up, and minimum power requirements when set temperature is obtained. High-speed Chromel-A coil elements work with fan-induced circulation of air to accelerate heating and insure even distribution throughout

the load. There is a time proportioning controller to protect against over-temperature.

Maximum temperature of the furnace is 1250° F. Models are available with work baskets from 22" to 36" in diameter, and from 30" to 48" in depth. A powerful gear-type mechanism permits effortless opening and closing of the heavily-insulated lid. The lid can be arranged for either right- or left-hand swing, or for universal operation in both directions.

Design and construction of the unit make it useful for tempering, annealing, stress relieving, precipitation hardening, and other heat treating applications. A bulletin is available.

For further information circle No. 13

NEW MANAGER

Mr. Carl F. Burling, Sales Manager, Industrial Heat Treating Division, Lindberg Engineering Company, Chicago 12, Illinois announced the appointment of E. L. Kemper as manager, Salt Bath Furnace Division.

Kemper was formerly with the A. F. Holden Company, Detroit. Lindberg now offers industry a complete line of salt bath furnaces featuring Lindberg-Upton equipment.

NEW ASM MANAGING DIRECTOR

Appointment of Allan Ray Putnam as Managing Director of the American Society for Metals was announced by Dr. Clarence H.

Lorig, President of the Society.

As Managing Director of the Society, Putnam will occupy a new position established by the ASM Board of Trustees following the death last May of William H. Eisenman, a founder-member of the Society and its well known national secretary and executive head for 40 years.

Mr. Putnam comes to the Society from Detroit where he was Assistant Executive Secretary of the American Society of Tool Engineers.

NEW HARDENING FURNACE

The Fred A. Snow Company of 1942 West Kinzie Street in Chicago, Illinois date their establishment back to 1917. They are considered to be one of the oldest heat treaters in the Chicago area. During the past 40 odd years, their services to a numerous and varied clientele have exhibited their adeptness in continuing to offer talents and processes consistent with the ever-changing advancements in metallurgical fields. Recently, the principals, C. A. Snow, son of the founder, K. W. Cook and A. L. De Hart inaugurated an extensive modernization and expansion program.

One of the latest additions is a heat treating furnace designed and built by Flinn & Dreffein Engineering Company, of Chicago. It is a semi-continuous chain hearth type capable of loadings up to 20,000 pounds, used in heating for hardening. While primarily designed for semi-automatic handling of bar

(Continued on page 46)

(Continued from page 5)

must be porous to permit relief . . . Where design permits, cadmium plated parts should be painted with a chromate-pigmented epoxy resin. Surfaces not accessible for plating can be given considerable protection through the use of the epoxy resin alone."

In one of several separately-staged sessions of the AWS, Robert E. Bockrath of Dow Chemical Company discussed the new heat-treatable magnesium-thorium alloys.

"Approximately 20 missiles," he said, "employ such alloys in applications through 700° F for the purpose of reducing weight and increasing strength."

Bockrath admitted that the new magnesium alloys are radioactive, due to their thorium content, but contended that their level of radioactivity is too low to be hazardous. Even when they are being heat treated or melted, he asserted, no toxic vapors are produced and no elaborate safety measures are required to protect operating personnel.

Fig. 4—View of the exhibit of Lindberg Engineering Co., Chicago, Ill.

Society for Nondestructive Testing Sessions

In another series of technical sessions which were separately held by the Society for Nondestructive Testing, the usefulness of ultrasonics in locating flaws in heat treated metal parts was stressed.

For instance, Donald C. Erdman of Sperry Products, Inc., stated that ultrasonic equipment, which is now capable of transmitting and receiving as many as 1000 impulses a second, has enough resolving power to permit the detection of relatively small discrepancies due to corrosion and erosion in thin-walled tubes and storage vessels.

Other Technical Sessions

Also separately presented were technical sessions of the American Institute of Mining, Metallurgical and Petroleum Engineers, during which Gordon W. Barr of Climax Molybdenum Company described some recent advances in high temperature molybdenum alloys—such as those containing 0.5% titanium and 30% tungsten. Barr did not contend that all problems associated with the tendency of molybdenum to corrode at temperatures well below its high melting point have been solved, but he did say that alloys capable of retaining high strength at temperatures above 1000° F. are now available.

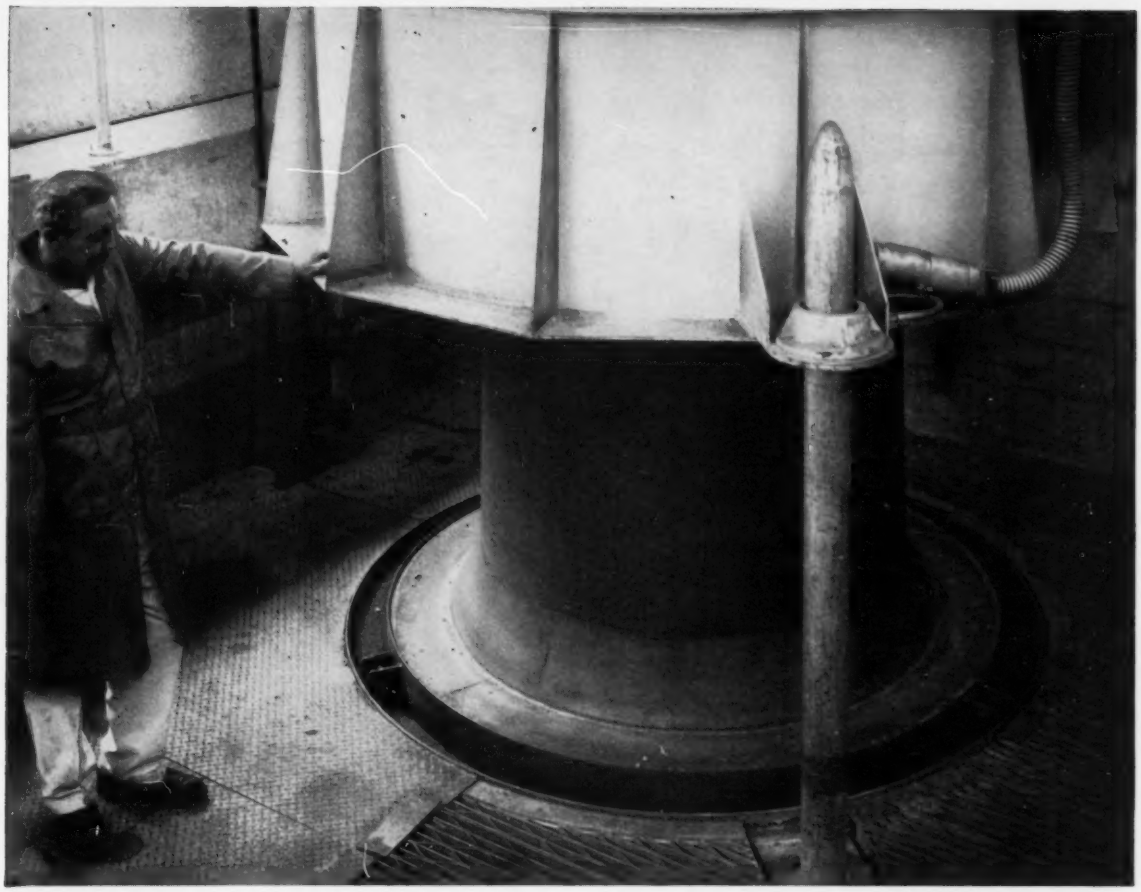
A special two-day series of ASM sessions on explosive forming climaxed the Western Metal Show for 1959. Explosive forming—whereby such things as gunpowder and dynamite are now being used as energy sources in the fabrication of tough new alloys—has been hailed in some quarters as a process than can eliminate the need for heat treatments. However, most of the nationwide panel of experts who were in attendance seemed to agree that in most instances explosives will merely facilitate the work of most heat treaters.

Dr. John S. Rinehart, director of the mining research laboratory at the Colorado School of Mines, for example, stated that explosive forming can eliminate straightening problems by making it possible to heat treat some metals before they are fabricated—since many alloys which are readily ruptured by low-energy forces manifest surprising plasticity when subjected to high-energy blows.

Fig. 5—Part of the exhibit of Hevi-Duty Electric Company, Milwaukee, Wis.

Other speakers like R. A. Cooley of Propellex Chemical Corporation asserted that explosives can in various ways be used for the sole purpose of hardening metal surfaces. For instance, rather mild charges have been safely and satisfactorily used to harden the surfaces of holes and other details which are too inaccessible to be treated by conventional methods.

Explosives were also mentioned as having some potential applications in connection with such things as salt bath treatments. • • •



Hard to destroy! Easy to get! Long-lasting Inconel alloy retorts like this one at Harvey Aluminum, used for preheating, austenizing, quenching and tempering, can be produced by your regular heat treating equipment fabricator.

After 15 months of 1875°F heat treating...

Inconel Retort at Harvey Aluminum proves fully as good as it looks

Light, fast-heating retorts of wrought Inconel* nickel-chromium alloy prove amazingly durable.

Here (above) is one of several retorts at the Harvey Aluminum, Torrance, California plant which demonstrate the point. It was fabricated by California Alloy Products.

In service, retort is heated in a hurry . . . held there several hours . . . then cooled rapidly to one or two hundred degrees. Up again. Soak again. Down again. Cycle after cycle. All the while retort is under attack by atmospheric and furnace gases.

Harvey Aluminum, one of the major producers of wrought aluminum mill products, has many good words to say about the dependability of their wrought Inconel retorts. And about the high quality and long life of extrusion and forging dies produced in them. Die surfaces are excellent. Distortion is minimum. Shapes can be intricate.

Takes on many tough jobs

Where conditions are severe as in neutral salts bath pots, for example, or vertical furnaces, or tool carburizing baskets, or burning tools, or any one of thousands of items of heat treating equipment . . . Inconel alloy provides the dependability needed for profits and quality.

For the latest ways to shave costs with long-lasting Inconel alloy equipment, write Inco for "Keeping Costs Down When Temperatures Go Up."

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO NICKEL ALLOYS

HEAT TREATING HINTS

(Continued from page 20)

ers designed for the ultimate in operational flexibility. The burners are controlled through motor operated air-gas proportioning valves coupled to a suitable temperature indicating controlling pyrometer.

The furnace construction is a welded steel shell reinforced with structural steel members, requiring no special foundation. It is lined with 4½" of firebrick, backed by 5" of 1600°F insulating brick. It has a useable heating area 36" wide by 72" long with a working height of 18".

The heavy cast iron door is lined with the necessary high temperature refractories and the entire assembly is chain operated and counter balanced for easy operation.

This furnace design is adaptable to many heat treating processes that require even heat distribution, rapid heating rates, and close temperature control. It is designed for accurate work for temperatures ranging from 500°-1800°F with an intermittent maximum of 2,000°.

Source—SUNBEAM METAL MINUTES Vol. 15, No. 5

Difficult Brazing Job Simplified by High Frequency Induction Heating

Accurate selective surface heating requires precise control of three variables: the amount, the duration and the location of the heat applied. On a hardening operation, for example, the precise control of heat results in the right degree of hardness and the correct depth of case in the area specified. On the brazing operation being done by the Cincinnati Inductron shown in Figures 1 and 2, precise control spells the difference between a correctly brazed joint and the destruction of an accurately adjusted, completely assembled instrument.

The parts being brazed on this machine are precision pressure transducers. These transducers

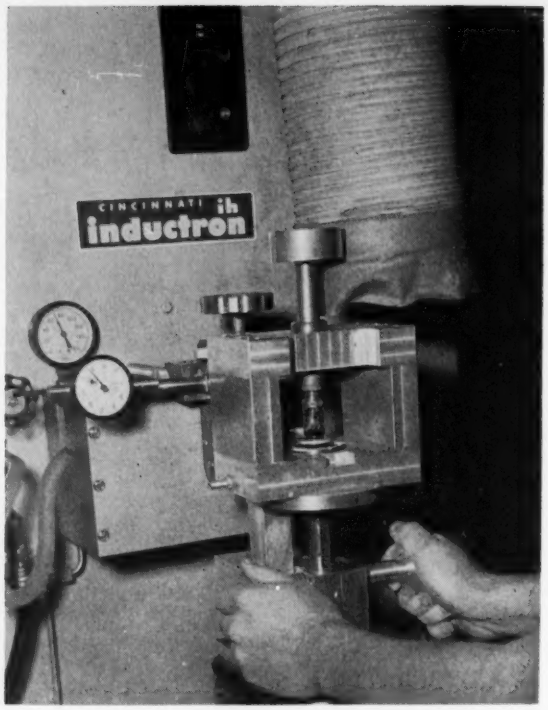


Fig. 1—Precise control and fast heating on Cincinnati Inductron permits successful brazing of assembled transducers. Transducer being positioned for brazing is a precision pressure type.

make possible accurate measurement of unit pressures ranging from fractions of an inch to tens of thousands of pounds per square inch. They are used in applications as diverse as guided missiles and chemical processing systems. But despite the sensitive nature of these instruments, brazing is not only practical but economical.

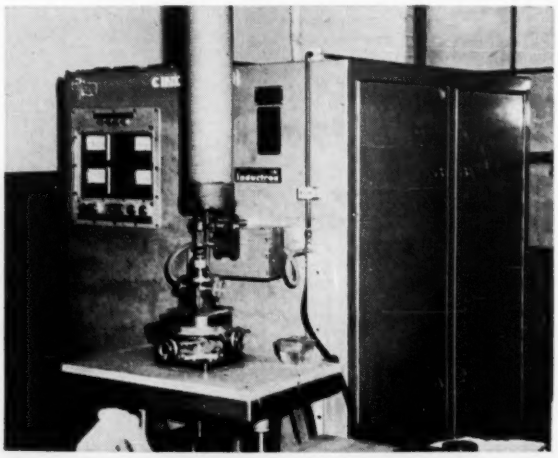


Fig. 2—Infinitely variable heat control on Inductron simplifies setup and assures duplication of results on brazing 150 different transducer tubes. Tubes are held by positioning fixtures located on adjustable table. Hose over fixture is for heat exhaust.

One of the factors contributing to the success of the brazing operation is the ability to bring the joint up to temperature in a very short space of time. On some of the transducers, for instance, the heating cycle is only .2 of a second. Rapid heating is possible because the Inductron is designed to generate a high frequency output—up to approximately one million cycles per second.

Precise control of this high frequency output is provided by a variable output transformer which allows the operator to vary the heating characteristics of the coil. By rotating a graduated dial he can "tune" the coil output to the precise setting required to restrict the heat to the area to be brazed. The rapid and concentrated application of heat to this area makes it possible to hold the total heat input to an absolute minimum which can be harmlessly dissipated after brazing without damage to the sensitive elements of the transducer.

Approximately 150 different sizes and styles of transducers are brazed by this 15KW Inductron. Lot sizes range from 1 to 50 instruments. In view of the frequent setup changes necessary, the infinitely variable heat control provided by the Inductron is particularly important on this operation. This feature not only simplifies the setup procedure, but assures duplication of results from lot to lot.

A record is kept of the precise settings required for a successful braze on each different tube. When a particular size and style of tube is to be brazed again, the heat control can be quickly adjusted to the specified setting and the fixture repositioned. Furthermore, since the heating characteristics of a coil can be varied by the output transformer, it is not necessary to stock a separate, accurately formed coil for each different tube. In fact, only 25 different coils are required to braze the 150 sizes and styles of transducers.

Source—"REPORT" published by Cincinnati Milling and Grinding Machines, Inc.

CONTROLLED CARBURIZATION

(Continued from page 8)

erated at 30°F dew point needled with approximately 8% raw methane, and is fed through the bottom of the retort and circulated through the load up to the furnace top where it is vented. A high speed retort fan assures uniform and ample circulation of the gas.

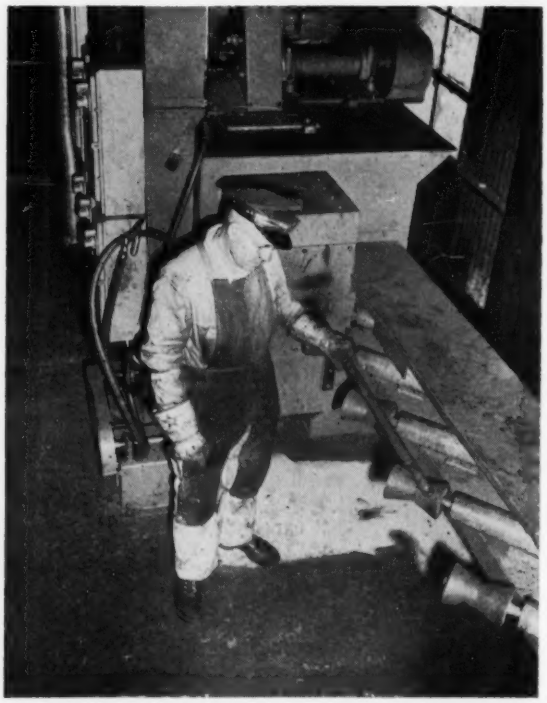


Fig. 2—Scale forms on the drill rods as a result of Gardner-Denver Company's heat treating process. This operator shown above is putting a drill rod through a shot peen cabinet that removes the scale and also imparts favorable stresses to the rod's surface.

Temperature uniformity is important in this operation. The amount of heat within the furnace is regulated by five Minneapolis-Honeywell and Wheelco pyrometers. After the designated time, the red hot load is lifted from the furnace and immediately quenched into rapidly circulating oil. The oil is kept at room temperature.

Upon cooling, the center fill is blown out of the rods and they in turn go through a second shot-peening process to afford a smooth, clean surface that is favorably stressed to increase the serviceability and life of the drill rod. Machine presses then straighten the rods and after inspection they are ready for assembly.

This heat treatment is given to steel to be used in long-hole drilling, blast-hole drilling for mining, construction and quarry work, and for exploration holes of various types. The sizes and shapes of the drills are dependent on whether they will go into the company's line of hand-held sinkers, stoppers, or drifters, or whether they will complement the larger jumbo, wagon, Air-Trac, or crawler drills. • • •

(Continued from page 18)

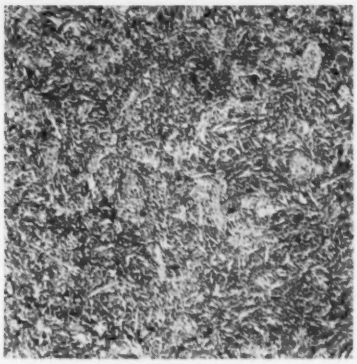


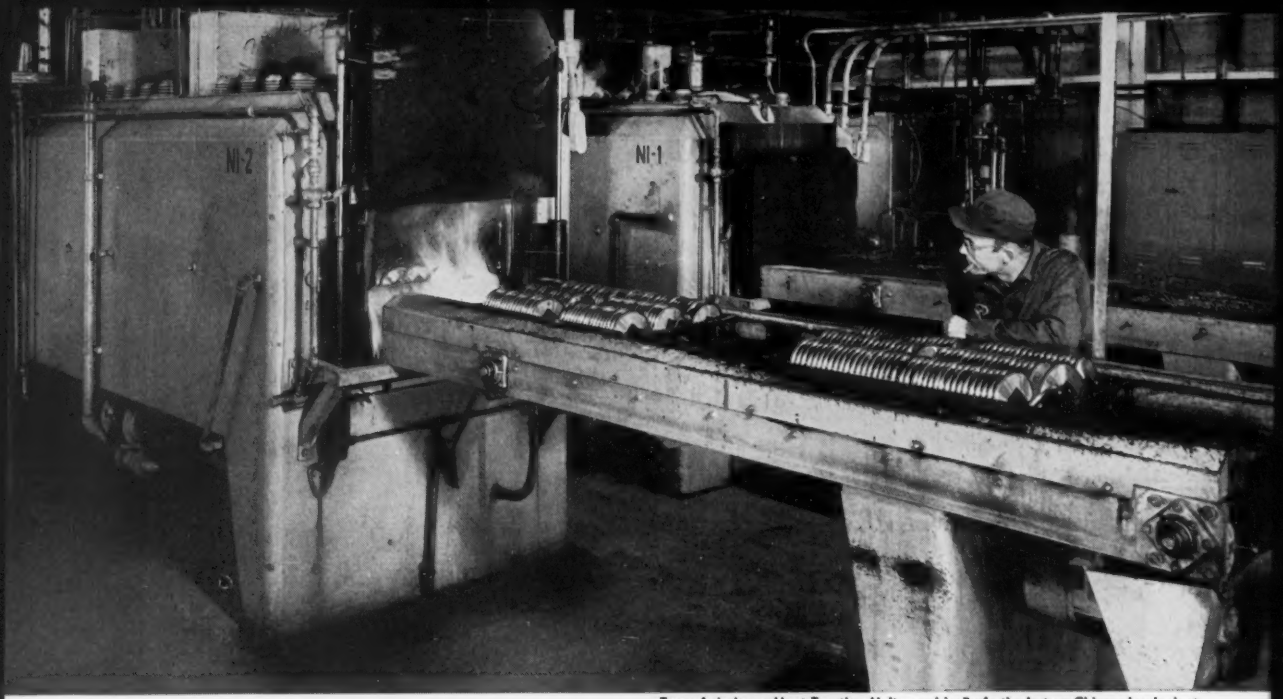
Fig. 6—Martensitic structure. Matrix of martensite with finely dispersed cementite grains, which have not dissolved during heating for hardening. x 500.

ment of atoms. For a cementite lamella to form, a concentration of carbon atoms is required, and this can only be obtained by their travelling to certain nuclei. This transport requires time.

The formation of martensite differs from those of pearlite and bainite in being practically independent of time. In this example it starts at about 390°F (Ms)[1] and continues as the temperature falls, until at about 85°F it is nearly 100 per cent martensite (Mf)[2].

That the formation of martensite is independent of time is illustrated by the horizontal line in the graph. At 210°F about 90 per cent martensite is formed and this proportion does not change to any extent with time as long as the temperature is kept constant. Martensite is the hard component found in hardened steel, Fig. 6. In this connection the risk of tempering a tool at "sizzle" temperature, about 210°—300°F, without first allowing it to cool down to room temperature is worth mentioning. When steel consisting of martensite together with a considerable amount of austenite is tempered, part of the retained austenite remains untransformed while part is transformed into untempered martensite. Both these constituents are normally considered undesirable in the hardened and tempered tool. *(To be continued.)*

[1] *Martensite transformation starts.*
[2] *Martensite formation finishes.*



Two of six Ipsen Heat Treating Units used in Perfection's two Chicagoland plants

"...with Ipsen heat treating units, we get bright work, and increase production per man-hour."

Perfection Tool and Metal Heat Treating Co.

Don Petersen is president of Perfection Tool and Metal Heat Treating Company, one of Chicago's largest and best known custom heat treating organizations. To learn firsthand how and why Perfection uses semi-automated, controlled atmosphere, heat treating equipment, we had an interesting chat with Mr. Petersen. Here are his answers to our questions:

Q. Since 1951 you have purchased a number of Ipsen "straight-through" heat treating units. Why have you favored this equipment?

A. We were well pleased with the first Ipsen furnace we bought, and our customers were well satisfied with the quality of the work that came out of it. Since the end of World War II, there has been a much greater demand for atmosphere work, and, as this demand increased, we have purchased additional furnaces. We have four Ipsen units in our Hubbard Street plant . . . and two in our branch plant in Lombard, Illinois. All six units have two work chambers which make them ideal for preheating.

Q. What kind of work do you handle in your Ipsen equipment?

A. In the course of the average day we handle many, many different types of work . . . gears, screw machine parts, stampings, etc. We use your furnaces for carburizing, carbonitriding, neutral atmosphere hardening, and carbon restoration. The versatility of Ipsen furnaces is quite a selling point as far as we are concerned.

Q. Have you been able to increase production with this equipment?

A. Yes. With Ipsen equipment we have substantially increased production per man-hour. One reason for this is that quenching is automatic . . . and our operators do not have to handle parts in and out of the quench by hand.

Q. Apparently you like the automatic quench feature. Why?

A. Definitely. The automatic timing makes it easy to duplicate previous quenching results. We eliminate the element of human error in quenching.

Q. What about maintenance of your Ipsen equipment?

A. You have an excellent record on this count. We find that your equipment requires very little maintenance.

Q. What do your men think of Ipsen equipment?

A. Our men like your equipment because it's cleaner, cooler, and easier to operate. It takes less effort per pound of work treated.

Q. Has Ipsen equipment permitted you economy of floor space?

A. Yes. We find your equipment to be quite compact for the amount of work handled. In our Hubbard Street plant four Ipsen units are placed so the discharge ends converge on the same washing and degreasing unit. The entire installation occupies only 600 sq ft of floor space.

A brochure describing the type of Ipsen equipment used in the Perfection plants is available. Ask for your copy.

AUTOMATIC Ipsen HEAT TREATING UNITS

IPSEN INDUSTRIES, INC. • 733 S. MAIN STREET • ROCKFORD, ILLINOIS

(Continued from page 26)

present regulations make the setting up of needed reserves almost impossible.

"Abuse of power by labor unions has been a factor in bringing about many mergers, and has resulted in countless small companies discontinuing business. Congress has done a lot of talking about labor monopolies and bad practices with which smaller businesses are unable to cope, but there has been a dearth of action in the direction of reform. Placing the unions under the anti-trust laws is one approach, but it is far from a cure. The only real answer is to 'unscramble' the biggest unions, giving the local labor leader dealing with local problems more autonomy, but leaving the labor Congress as a strong governing body.

"Right now, the big unions are able to justify much of their monopolistic power by showing they need it to bargain with equally monopolistic industries. An 'unwinding' of the giant corporate combines would remove this defense.

"This country was built up on the idea that widespread, independent ownership of farm, home and business enterprise is the only foundation upon which a free society can be established. Under this system, America gave more people in more places an opportunity to participate as independent individuals in the production and distribution of goods and services than any other nation in history, and by so doing our free enterprise system became the envy of the world.

"People who patronize independent businesses—who raise their voices against undue power wherever it exists—are the Economic Patriots of the Twentieth Century."

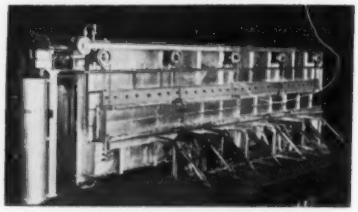
SMALL INVESTMENT COMPANY

Charles I. Wesley, Chairman of the Board of Charles Wesley & Associates, and President of two member MTI companies, Allied Metal Treating Corporation, Milwaukee, Wisconsin, and Allied Metal Treating Corporation of Illinois, Chicago, has announced that he is in the process of negotiating with the Small Business Administration in Washington for the possible formation of a small business investment company to be licensed under the Small Business Investment Act of 1958.

Two licenses to small business investment companies were recently announced by Wendell B. Barnes, Administrator of the Small Business Administration, and Charles Wesley is presently applying for a license. If granted, his new small investment company will seek to assist diversified small businesses in the midwestern area.

(Continued from page 37)

stock, the furnace is capable of handling a diversity of sizes and shapes. The operating temperature range extends to a maximum of 1800° F and firing is by use of natural gas. The furnace has a depth of 6 feet with a length of 27 feet. The front end contains a motor-operated sectional door extending the entire length of the furnace. The height of the door opening is one foot nine inches. The door, while sectional, is designed to obtain minimum leakage when in its closed position. The hearth of the furnace is supported by ten-inch high refractory piers. The arch is Bigelow Liptak. Four stands of heavy duty alloy chains with integral pusher pins are channeled into the hearth.



These chains are motivated by a roller chain drive with speed reducer and motor having a reversing magnetic starter with push-button control. The chains pass through slotted apertures in the door extending beyond the door to accommodate loading by overhead means preparatory to charging the furnace. Air loaded chain take-ups are employed individually to each chain. Inactivation of air pressure when not transporting loads eliminates strain on the chain conveyors at all other times.

Heating is accomplished through the use of Bloom tempered flame gas burners firing from the rear wall in a pattern of both under and over the work. A total of eighteen burners are used, half of which fire over the load with the remainder firing under the load beneath the hearth tile. These burners are operated at constant air flow with turn down on gas flow only. Thus the heating chamber is under a fairly constant positive pressure at all times. The burners are divided into three zones; two end zones of four burners each, and a center zone of ten burners. Each zone is controlled by a Wheelco Model 405 proportioning controller. Additional instrumentation consists of a strip recorder wired to provide overheat shutoff. Openings are provided in the hearth tile along the front of the furnace immediately inside the door opening for discharge of gases from the lower burners. In addition flues with provision for restriction of the openings are provided above and below the hearth.

The furnace is extremely versatile in operation. Bar stock 1" to 14" in diameter and 4 feet to 26 feet in length can be handled in mixed loads. Each bar is individually quenched in either water or oil.

Bar stock larger than 4½" diameter is picked off the chains with a wide spaced hook and lowered into the quench using the overhead crane. The chains will handle hex, square and flat bars as well as a variety of shapes. By running the section of chain without pusher pins onto the hearth almost any size or shape can be manually loaded and unloaded. A two man crew handle all operations easily.

For further information circle No. 14

(Continued on page 49)

(Continued from page 3)

the form of carbon concentration test-bars are added to regular process loads for the determination of carbon gradient, and to insure that surface carbon and case depth are within allowable limits.

In general, depending upon the case depth required, three major cycles of operation are in current usage. Total cyclic times range from 4.5 hours to 10 hours, covering the actual time interval elapsing between charge of a tray of parts into the first heating zone, through the subsequent holding time and quenching operation. The temperature normally utilized is 1700°F., although the present furnaces are designed for maximum continuous operation at 1850° F. Current practice calls for equal time in the first, or preheating zone and the second, or holding zone. Based on actual test data secured, the time interval of each cycle based on elapsed time between entry of the cold work to the first zone, and the discharge of the carburized work from the second zone is predicated upon time for heating to carburizing temperature, plus a predetermined amount of carburizing time in the first furnace zone. The second zone dewpoint is controlled to give approximately .90 - .95 surface carbon.

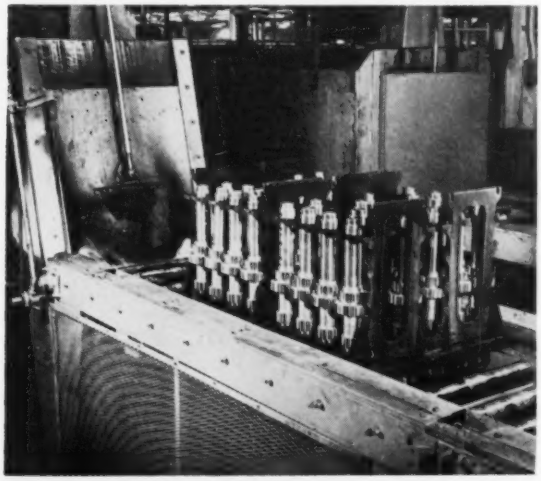


Fig. 3—Cast tray and fixture adapted to counter shafts, ready for charging into carburizing furnace. Discharge end of tempering furnace adjacent to right.

Dependent upon the type of steel used in the gears, counter shafts, etc., the temperature of the quench oil is normally held to beneath 200°F. However, on certain parts, particularly some of those carbonitrided, and of shape or section where deformation in quenching might prove troublesome, the design of the quenching equipment permits the use of oil heated to temperatures in the range of 300° to minimize distortion. In the event of necessity, quench oil temperatures as high as 400° F. would be permissible in this furnace equipment, since both quench-oil heating and cooling means are provided, and the entire liquid en-

(Continued on page 48)

GAS CARBURIZING

(Continued from page 47)

closure is contained in an insulated double shell.

The addition of ammonia in regulated quantities to the endothermic type protective gas atmosphere employed, imparts a file hard carbonitrided case to such parts as power take-off gears, shifting forks, and washers. The work is produced clean and scale free from these operations, and after the removal of the residual quench oil in the washing machine, the majority of parts are passed without reloading, through the tempering operation for reheating to temperatures in the range of 325° to 350° F.

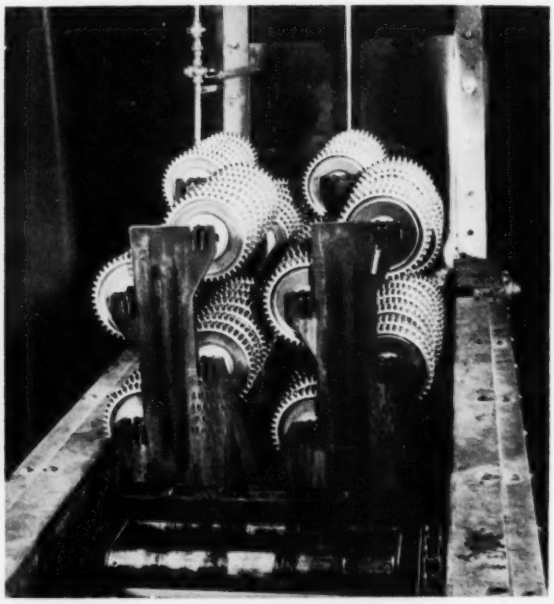


Fig. 4—Cast tray and fixtures loaded with steel gears. Note test bar suspended to upper right of charge.

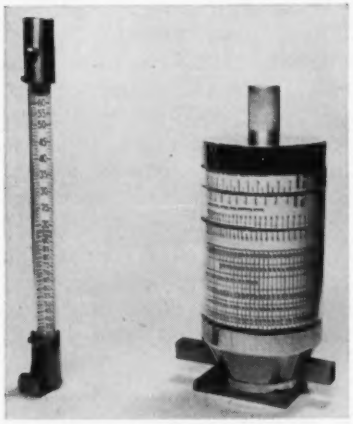
Experience with these furnaces indicates that the time required to bring a given charge to temperature, as compared with an equivalent time in a multi-row furnace equipment, is considerably lessened due to the application of large volumes of continuously reheated atmosphere passed through and around the charge by means of directional flow baffles, and roof mounted centrifugal fan equipment driven at synchronous speeds. This arrangement insures high static pressure circulation at velocities in excess of 40 feet per second. Not only is heating rate from ambient to carburizing temperature enhanced, but the independence of the system from radiated heat transfer insures that all parts of the given charge are brought to uniform temperature simultaneously, with irregularities due to position in the charge or thickness of section, minimized. Since actual diffusion time under identical circumstances of temperature and atmosphere should not vary, the actual savings involved in faster heating from ambient to carburizing temperature is in the floor space required for equipment of a given productive capacity. • • •

NEWS TO HEAT TREATERS

(Continued from page 46)

PORTABLE HARDNESS TESTERS

Two new low-cost portable hardness testers have been announced by Peabody Instrument Co. The "Hardnescope" pocket size, incorporating full range Rockwell B & C equivalent scales, operates on the rebound principle. Its features include friction-free operation, test-block accuracy, mark-free testing, and no anvil is required. The unit is complete with extra chrome alloy steel test balls and mahogany carrying case. Total weight approximately 10 ounces.



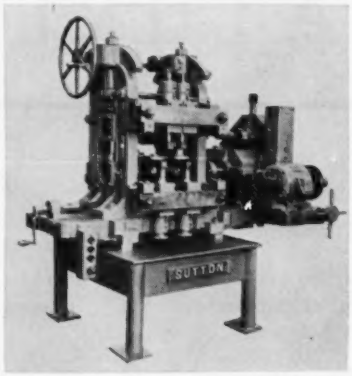
The "Brinellograph Computer" incorporates a full range 300 kg. load Brinell equivalent scale with Rockwell B and C conversions and tensile strength equivalents. Hammer strike loaded, deformation is made with standard 10 mm. steel ball.

For further information circle No. 15

NEW STRAIGHTENING AND CONTOUR CORRECTING MACHINE

A new patented Sutton Contour Correcting Machine is said to correct cross-sectional distortions of aluminum and other types of extrusions to close tolerances. Flat sections up to about 14" wide can be handled and multiple corrections of shapes circumscribed by a 9" circle can be made in one pass. The machines are made in various sizes and capacities and multiple stands may be used if required. Shapes of all modern metals can be corrected.

The design of the machines is intended to accommodate the many possible cross-sectional distortions that occur in the extrusion and *heat treatment* of complex shapes.



Correcting mechanism consists of two main-drive spindles with rolls, which may be used for correcting as well as traction, and up to eight correcting idler rolls, which may be positioned in many different ways on as many as twelve tool holder positions.

For further information circle No. 16

CONFERENCE ON FRACTURE OF ENGINEERING MATERIALS

The Eastern New York Chapter of the ASM will sponsor a conference on the "Fracture of Engineering Materials" on August 23, 24, and 25 on the campus of Rensselaer Polytechnic Institute in Troy, N. Y. The purpose of the conference is to review the current status of the fracture problem as it relates to materials of interest to the metallurgical, materials, and mechanical engineer.

A tentative program has been prepared to include such topics: "Ductile-Brittle Transitions in Metals;" "Temper Embrittlement;" "Hydrogen Embrittlement;" and "Fracture at Elevated Temperature;" and national authorities have agreed to present these topics.

For further information circle No. 17

NEW 80% ALUMINA PLASTIC REFRACTORY

Refractories Division, H. K. Porter Company, Inc., has just developed a new 80% alumina plastic refractory. It combines all of the advantages of monolithic construction, formerly available only in castables and ramming mixes, with the advantages of plastic construction, which are: air and gas tight, no special shapes needed, high thermal shock resistance, withstands heavy loads and temperature variations, and delivers long service life.

Porter "Pitco 80" is recommended to: a) balance refractory linings in high temperature furnace installations, and b) for linings where iron oxides and molten aluminum are prime causes of failure.

"Pitco 80" has the following features: 1. Packaged in densified deaired slabs; 2. Proper workability; 3. Needs no forms; 4. Fast installation; 5. Faster heat up than ramming mixes or castables; 6. Withstands temperatures to 3,200° F.

For further information circle No. 18

METALLURGICAL RESEARCH AWARD

Dr. Alexander R. Troiano, Head of the Department of Metallurgy at Case Institute of Technology since 1953, has been selected as recipient of the Research Award of the Case Chapter of the Society of the Sigma Xi for the current academic year.

Dr. Troiano's selection was based on his extensive research investigation in the metallurgy of steel and of titanium alloys. In 1956 he received the Howe Medal from the American Society for Metals for his metallurgical research.

MANUFACTURERS' LITERATURE

For your copy circle the number on the Readers' Service Card

AIRCRAFT TUBING HANDBOOK

Ohio Seamless Tube has just published a revised and up-dated version of their popular Technical Handbook A-2 which describes seamless aircraft tubing, carbon and alloy steels. Its 70 pages cover definitions, military and AMS specifications, sizes, tolerances, sampling, testing, packing, marking, machining, *heat treating,* properties and mill practices. Information is presented with charts, tables, and drawings where applicable.

For further information circle No. 19

CHROMALLIZING APPLICATIONS

A four-page folder available from Chromalloy Corporation, describes fifteen commercial applications of the Chromallizing process for diffusing chromium and other elements into the surface of metal parts to increase their heat, wear and corrosion resistance.

For further information circle No. 20

NEW LEVETROL BRINE SYSTEM

The Morton Salt Company recently introduced Morton Levetrol —this is a method of liquid level control in a wet salt storage system where water level automatically is proportioned to brine withdrawn.

The Morton Levetrol System is adaptable to any wet salt storage system. It protects against salt loss due to brine overflow by balancing water level with salt level. Levetrol solves the problem of salt and water inventory — protects against completely drained salt storage supply — enables you to have complete automation of your entire water treatment system.

Levetrol eliminates the problem of corroding float valves. All Levetrol controls are located away from your brine storage supply to completely avoid corrosion and assure convenient, accurate salt measurement and proper brine strength at all times. A bulletin is available.

For further information circle No. 21

LOCATING INVISIBLE DEFECTS

A new bulletin describes the Ferroflux method of locating invisible defects in ferrous metal parts and assemblies.

The system is said to locate discontinuities such as subsurface cracks, laps, voids, as well as grinding, welding and heat treating cracks—even through painted or plated surfaces—without damage to the part or danger to operator.

In operation, the part to be inspected is magnetized and painted or sprayed with an iron oxide solution. Iron particles in the solution concentrate wherever there is a defect. Either fluorescent or non-fluorescent solutions may be used.

For further information circle No. 22

NEW ULTRASONIC BOOKLET

Ultrasoundings, a new quarterly illustrated review of ultrasonic progress, has been launched by Acoustica Associates, Inc., Mineola, New York and Los Angeles, California, manufacturers of ultrasonic systems.

The first issue includes several feature articles describing ultrasonic cleaning applications in industry and informs users how to get the most from this fast-growing industrial processing technique. In addition, the publication includes brief descriptions of recent new developments by Acoustica.

For further information circle No. 23

PIT HEAT TREATING FURNACES

Calalloy Products Co., Los Angeles, is offering a 4-page, illustrated bulletin describing its custom-engineered pit furnaces for all metal heat treating industries.

They are said to be designed by high-temperature alloy specialists, to have precision control of temperatures and atmosphere, to contain all standard parts with no unnecessary extras.

These pit furnaces are gas-fired or electric with temperature ranges from 300°-2500° F.

For further information circle No. 24

INDUSTRIAL PROCESSING EQUIPMENT

Industrial Metal Fabricators Company, Detroit, has recently published a 12-page, illustrated booklet describing its wide range of industrial processing equipment including washers, draw furnaces, conveyors, and automated units.

The company maintains that all of its equipment can be furnished complete with electrical, pneumatic, hydraulic, steel, fuel, or other applicable controls as required.

For further information circle No. 25

SHOT PEENING TEXTBOOK

The 6th edition of a Shot Peening textbook, revised to include latest information obtained in research, development and practical applications, has been published by Wheelabrator Corporation, Mishawaka, Ind., manufacturers of airless blast cleaning equipment, dust collection equipment, and steel abrasives.

The book contains approximately 200 pages of printed and illustrative material, including photographs, drawings, diagrams, charts, and graphs. The first part of the book is devoted to applications and advantages of shot peening and the equipment and procedures involved. The second part covers the theory of pre-stressed surfaces in relation to shot peening and reviews the history of surface compression methods and their relation to fatigue. The price is $2.50.

For further information circle No. 26

FINISHING SYSTEM

An efficient finishing system must be more than just a series of cleaning, rust-proofing, drying, painting and finish baking units placed end-to-end on a conveyor line. It must be planned carefully with respect to products processed, type of finish applied — engineered and coordinated to produce the finest finish obtainable at the lowest per unit cost.

A new 12-page publication published by the Industrial Equipment Division of the R. C. Mahon Co. emphasizes the necessity of the above with many illustrations, featuring typical custom installations. Besides information on finishing, the publication has ideas for improving or building new installations.

For further information circle No. 27

FURNACE CATALOG

An 8-page, 2-color, illustrated catalog has been published by Dempsey Industrial Furnace Corporation, Springfield, Mass., which describes and illustrates all of the many different kinds of Dempsey engineered furnaces which meet every type of heat treating need. The furnaces are oil, gas, or electric fired, and tailored to individual specifications.

For further information circle No. 28

ALUMINUM BRONZE ALLOYS

A new catalog concerning Wearite® Aluminum Bronze Extruded Alloys 4-11 and 4-13 has just been published by the Peninsular Steel Company of Detroit.

Typical chemical composition, mechanical and physical properties, and applications are all included.

For further information circle No. 29

DIE BASE CATALOG

Columbia Engineering Co., Inc., Newark, N. J., manufacturers of standard and special nested plastic molds and die bases, has prepared a complete catalog and pricing chart for all possible types of bases which are of interest to the plastic and diecasting industries.

For further information circle No. 30

LETTERS TO THE EDITOR

Gentlemen:

We revert today to your earlier letter and send you enclosed a copy of our trade paper "Lygteposten" in which we bring a translation into Danish of your "Heat Treating Hints" column that appeared on page 16 in the January-February issue.

"Lygteposten" is sent out in 3000 copies to engineers and foremen in the Danish steel-using industry.

We thank you for your help.

Uddeholm Steel Company
Kobenhavn,
Sweden

Gentlemen:

I recently had the opportunity of reading the July-August, 1958 issue of *Metal Treating* and found it very informative.

I would appreciate receiving future copies by being placed on your mailing list.

C. B. Kiehle
Industrial Engineer
Michigan Consolidated Gas Co.,
Detroit, Mich.

Gentlemen:

We are interested in obtaining copy of the article by Frank J. Rizzo entitled "Processes and Techniques for Achieving Extreme Surface Hardness and Wear Resistance", which appeared in your magazine in the January-February 1957 issues.

May we ask that you forward copy and invoice for same?

(Miss) Corinne Krampf
Librarian
Olean, N. Y.
Van Der Horst Corp. of America

Gentlemen:

I have seen your magazine, *Metal Treating,* and very much liked it. At your earliest convenience would you please add my name to your mailing list.

Our subsidiary, Kinetics Corporation, does a great deal of heat-treating of metals and brazing work, and we find your magazine to be of value and very informative on this subject.

J. B. Merrill
President
High Vacuum Equipment Corporation
Hingham, Mass.

Gentlemen:

I would like very much to receive the magazine *Metal Treating.* I find the articles interesting and informative.

Dale C. McKissick,
Metallurgist
Houston, Texas
Reed Roller Bit Co.

Gentlemen:

I have received a copy of the Nov.-Dec. issue of your very interesting publication and would like to know more about the details concerning subscription.

F. R. Bayne
Chief Engineer
Alten Foundry & Machine Works, Inc.
Lancaster, Ohio

Dear Sirs:

When Mr. Horace C. Knerr spoke to ASM members in Charlotte, North Carolina some time ago, he asked those of us who wished to, to sign up for your marvelous publication *Metal Treating.* I did, and have enjoyed using its information.

I have since moved away from North Carolina and am now associated with P. R. Mallory & Co.'s Vibrator Division at Du Quoin, Illinois. I would appreciate it greatly if I could receive your publication at my new address.

August F. Engelberg
Tool Design Engineer
Vibrator Division
P. R. Mallory & Co. Inc.
Du Quoin, Ill.

QUENCHING BATH CHEMICAL

(Continued from page 10)

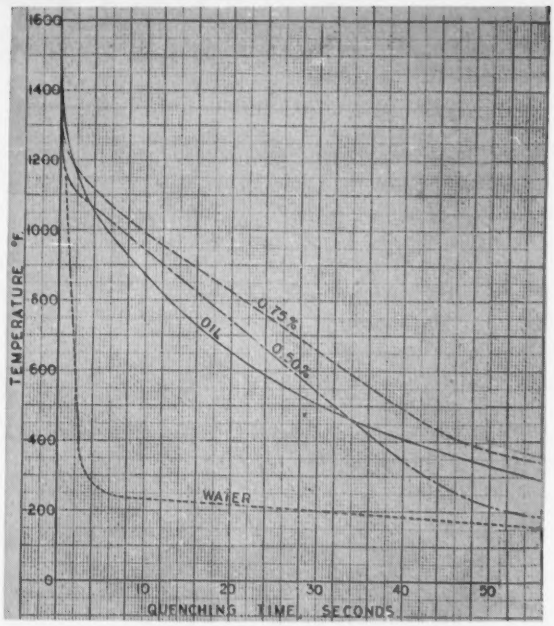


Fig. 2—Curves showing the mean of the data derived from Fig. 1 and including a comparison with water.

residue. In experimenting with the solution, it is recommended that a 0.5 per cent solution by weight of "Hannite" be used initially. This solution will correspond very closely to conventional quenching oils.

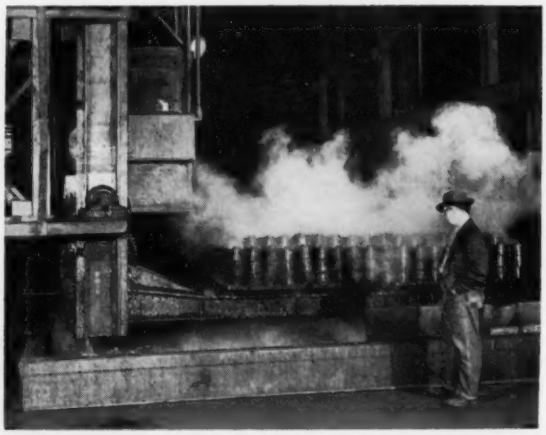


Fig. 3—Material being removed from a quenching bath containing "Hannite."

It is absolutely essential to agitate the quenching bath in accordance with good quenching practice. This is particularly important since the material is a water solution and to obtain the optimum results, agitation must be such that steam pockets which would form on the hot metal be removed.

Advantages gained from using this quenching bath chemical are said to be safety from fire, no disagreeable odors, aid in keeping the plant clean, lower insurance costs, and superior metallurgical control. • • •

Used Heat Treating Equipment For Immediate Sale and Removal At Tremendous Savings

GE GLOBAR HEAT TREATING FURNACES (TYPE TG2414)
Also used for forging

CATALOG No. 158L110

Furnaces complete with Leeds & Northrup Speedomax and Micromax Controls;
Marcus 40 KV, Single Phase Transformers;
Working dimensions 24" x 14" x 5"
Overall dimensions 40⅝" x 83¼" x 70"
Maximum temperature 2400°F
Year of Manufacture 1953-1955

Original cost $7149.00
OUR PRICE . . . . $1755.00 f.o.b. Holyoke, Mass.

SUNBEAM HEAT TREATING FURNACE (Serial No. 25578)
Fully automatic for production

Unit is 40′ at 2200°F with Automatic Conveying System into quench tank;
. . . Work follows into 90° conveyor unit into approximately 40′ draw furnace at 1500°F;
. . . Then into 30′ cooling table.
Furnaces complete with all motors and electrical controls;
Gas and oil fired complete with conveyor, quench tank, and draw furnace
Year of Manufacture 1953

Replacement cost $180,000.00
OUR PRICE . . . . $ 29,500.00 f.o.b. Holyoke, Mass.

HARRIS DEEP FREEZE UNIT FOR METAL TREATING

Two chambers: +150° to —100°F; +100° to —100°F
Three compressors, 2 motors. New 1952

OUR PRICE . . . . $950.00 f.o.b. Holyoke, Mass.

For the Forging Shop we carry a full line of rotary forging furnaces . . .
Quotations and specifications will be furnished upon request.

We are interested in purchasing any capacity Lepel Induction Heaters from 2KV up. *We pay the highest prices.*

FOR FURTHER INFORMATION AND PRICES, WRITE - WIRE - PHONE

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Largest Machinery Warehouse in New England

739 Boylston Street **Boston, Mass.**

Telephone: COpley 7-5852

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ARMOUR AMMONIA DIVISION
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Chicago, Illinois

AMMONIA STORAGE EQUIPMENT

ARMOUR AMMONIA DIVISION
1355 West 31st Street
Chicago, Illinois

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

CARBURIZING COMPOUNDS

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

FABRICATION
(Heat & Corrosion Resistant)

ALUMINUM AND ARCHITECTURAL METALS COMPANY
1974 Franklin Street
Detroit 7, Michigan

BLAW-KNOX COMPANY
NATIONAL ALLOY DIVISION
Pittsburgh 38, Pennsylvania

ECLIPSE FUEL ENGINEERING CO.
1018 Buchanan Street
Rockford, Illinois

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

ROLOCK, INC.
1232 Kings Highway
Fairfield, Connecticut

STANWOOD CORPORATION
4825 West Cortland Street
Chicago 39, Illinois

WIRETEX MFG. CO., INC.
16 Mason Street
Bridgeport 5, Connecticut

FIXTURES

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

ALUMINUM AND ARCHITECTURAL METALS COMPANY
1974 Franklin Street
Detroit 7, Michigan

ECLIPSE FUEL ENGINEERING CO.
1018 Buchanan Street
Rockford, Illinois

INTERNATIONAL NICKEL CO., INC
67 Wall Street
New York 5, New York

ROLOCK, INC.
1232 Kings Highway
Fairfield, Connecticut

STANWOOD CORPORATION
4825 West Cortland Street
Chicago 39, Illinois

WIRETEX MFG. CO., INC.
16 Mason Street
Bridgeport 5, Connecticut

FLAME HARDENING

META-DYNAMICS DIVISION
THE CINCINNATI MILLING MACHINE COMPANY
4701 Marburg Avenue
Cincinnati 9, Ohio

SELAS CORPORATION OF AMERICA
Dresher, Pennsylvania

FLOW MEASUREMENT

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

SELAS CORPORATION OF AMERICA
Dresher, Pennsylvania

WAUKEE ENGINEERING CO.
5137 North 35th Street
Milwaukee 9, Wisconsin

FURNACES

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

ECLIPSE FUEL ENGINEERING CO.
1018 Buchanan Street
Rockford, Illinois

FLINN & DREFFEIN ENGINEERING COMPANY
36 South Wabash Avenue
Chicago 3, Illinois

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

HEVI-DUTY ELECTRIC CO.
P. O. Box 563
Milwaukee 1, Wisconsin

CHARLES A. HONES, INC.
Baldwin, L. I., N. Y.

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

LUCIFER FURNACES, INC.
Neshaminy, Pennsylvania

PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

SELAS CORPORATION OF AMERICA
Dresher, Pennsylvania

FURNACES (Salt Bath)

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

AMERICAN GAS FURNACE CO.
808 Lafayette Street
Elizabeth, New Jersey

ECLIPSE FUEL ENGINEERING CO.
1018 Buchanan Street
Rockford, Illinois

HEVI-DUTY ELECTRIC CO.
P. O. Box 563
Milwaukee 1, Wisconsin

CHARLES A. HONES, INC.
Baldwin, L. I., N. Y.

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

LUCIFER FURNACES, INC.
Neshaminy, Pennsylvania

FURNACES (Vacuum)

FLINN & DREFFEIN ENGINEERING COMPANY
36 South Wabash Avenue
Chicago 3, Illinois

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

HEVI-DUTY ELECTRIC CO.
P. O. Box 563
Milwaukee 1, Wisconsin

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Illinois

NEW YORK AIR BRAKE COMPANY
KINNEY MFG. DIVISION
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Boston 30, Massachusetts

PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

EQUIPMENT AND MATERIALS DIRECTORY *(Continued)*

GAS BURNERS & TORCHES

CHARLES A. HONES, INC.
Baldwin, L. I., N. Y.

GAS GENERATORS

AMERICAN GAS FURNACE CO.
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Elizabeth, New Jersey

FLINN & DREFFEIN ENGINEERING COMPANY
36 South Wabash Avenue
Chicago 3, Illinois

C. I. HAYES, INC.
816 Wellington Avenue
Cranston 10, Rhode Island

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715 South Main Street
Rockford, Illinois

LINDBERG ENGINEERING COMPANY
2466 West Hubbard Street
Chicago 12, Ilinois

PACIFIC SCIENTIFIC COMPANY
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Los Angeles 22, California

GAS MIXING EQUIPMENT

WAUKEE ENGINEERING CO.
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Milwaukee 9, Wisconsin

GASES

ARMOUR AMMONIA DIVISION
1355 West 31st Street
Chicago, Illinois

HARDNESS TESTERS

WILSON MECHANICAL INSTRUMENT DIV.
AMERICAN CHAIN & CABLE COMPANY, INC.
230 Park Avenue
New York 17, New York

HEATING ELEMENTS
(Non-Metallic)

NORTON COMPANY
622 New Bond Street
Worcester 6, Massachusetts

HIGH TEMPERATURE FANS

GARDEN CITY FAN COMPANY
801 North Eighth Street
Niles, Michigan

INDUCTION HARDENING

META-DYNAMICS DIVISION
THE CINCINNATI MILLING
MACHINE COMPANY
4701 Marburg Avenue
Cincinnati 9, Ohio

METAL FINISHING

HEATBATH CORPORATION
P. O. Box 78
Springfield 1, Massachusetts

OVENS

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PROTECTIVE COATINGS

MARKAL COMPANY
3102 W. Carroll Avenue
Chicago 12, Illinois

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

QUENCHING OILS

E. F. HOUGHTON & CO.
303 West Lehigh Avenue
Philadelphia 33, Pennsylvania

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

SINCLAIR REFINING COMPANY
600 Fifth Avenue
New York, New York

SUN OIL COMPANY
INDUSTRIAL PRODUCTS DEPARTMENT
Philadelphia 2, Pennsylvania

REFRACTORIES

NORTON COMPANY
622 New Bond Street
Worcester 6, Massachusetts

SALTS (Heat Treating)

AMERICAN CYANAMID COMPANY
PROCESS CHEMICALS DEPARTMENT
30 Rockefeller Plaza
New York 20, New York

HEATBATH CORPORATION
P. O. Box 78
Springfield 1, Massachusetts

E. F. HOUGHTON & CO.
303 West Lehigh Avenue
Philadelphia 33, Pennsylvania

PARK CHEMICAL COMPANY
8074 Military Avenue
Detroit 4, Michigan

SPECIAL CONTROL EQUIPMENT

AJAX ELECTRIC COMPANY
940 Frankford Avenue
Philadelphia 23, Pennsylvania

IPSEN INDUSTRIES, INC.
715 South Main Street
Rockford, Illinois

STRAIGHTENING EQUIPMENT

BLAW-KNOX COMPANY
NATIONAL ALLOY DIVISION
Pittsburgh 38, Pennsylvania

TEMPERATURE CONTROLS

MARKAL COMPANY
3102 West Carroll Avenue,
Chicago 12, Illinois

WEST INSTRUMENT CORPORATION
4363 West Montrose
Chicago 41, Illinois

TESTING EQUIPMENT

PACIFIC SCIENTIFIC COMPANY
P. O. Box 22019
Los Angeles 22, California

RIEHLE TESTING MACHINES DIVISION
AMERICAN MACHINE AND METALS, INC.
East Moline, Illinois

WILSON MECHANICAL INSTRUMENT DIV.
AMERICAN CHAIN & CABLE COMPANY, INC.
230 Park Avenue
New York 17, New York

TOOL STEELS

BETHLEHEM STEEL COMPANY
Bethlehem, Pennsylvania

Index To Advertisers

Braze and Anneal at operating temperatures from 400°F to 2150°F

Model 88 Bell Retort Furnace.

AGF'S BELL RETORT FURNACES

Removable bell retorts containing work pieces are heated within a cylindrical furnace, as a low dew-point, dry hydrogen or cracked ammonia atmosphere is maintained.

The completely new combustion system provides uniform heating at operating temperatures from 400° to 2150° F.

For:

Bright Copper Brazing of stainless and regular steel.

Nickel-Chromium Alloy Brazing of stainless up to 2150° F.

Bright Annealing of Stainless Alloy, ferrous and non-ferrous materials.

Hydrogen Cleaning or reduction of chromium oxides on stainless.

Without modification, versatile Bell Retort Furnaces can also be employed for nitriding, carburizing and ammonia-gas case hardening.

Semi-continuous operation with multiple bell retorts . . . One bell retort is heated . . . another cools under atmosphere protection . . . and a third is loaded.

Removable bell retorts eliminate cleaning, conditioning and decontaminating of a fixed muffle.

Model 239 Bell Retort Furnace. Box shaped car type retort.

AGF'S CAR TYPE BELL RETORT FURNACES

Designed to meet the need for large capacity batch type stainless processing . . . for handling unusually shaped pieces or heavy work loads. Box shaped bell retort is rolled into and withdrawn from the furnace by means of a chain driven mechanism.
Bell Retort cover is easily removed for loading and unloading.

Rapid and efficient heating is obtained because the bell retort is charged into a hot furnace.

AMERICAN GAS FURNACE CO.

808 LAFAYETTE STREET — ELIZABETH 4, N. J.

"The Standard of the Industry Since 1878"

Salt bath heat treating helps put you in a better competitive situation!

The Ajax files are full of case history records such as these. Each represents a typical instance where replacement of other heat treating systems with Ajax Salt Baths have meant important cost reductions or greatly improved quality—*and usually both:*

$37,000 WAS SAVED in 8-months by an Ohio manufacturer through using an Ajax Electric Salt Bath installation for 4 different cost-cutting operations i.e. carburizing, simultaneous carburizing and brazing; brazing; and hardening.

A 350% PRODUCTION INCREASE in 45% less space with 50% less labor was achieved in carburizing bearing races in a 6-unit Ajax Electric Salt Bath installation.

A 60% COST REDUCTION in case hardening body screws was scored by a single Ajax Salt Bath no larger than your desk but handling 390 lbs. of work per hour.

AN 80% REDUCTION in finish grinding time was obtained by martempering SAE-52100 bearing races in an Ajax installation. Drawn to Rc 62-63, the races showed average out-of-round distortion of only 0.002-0.003″.

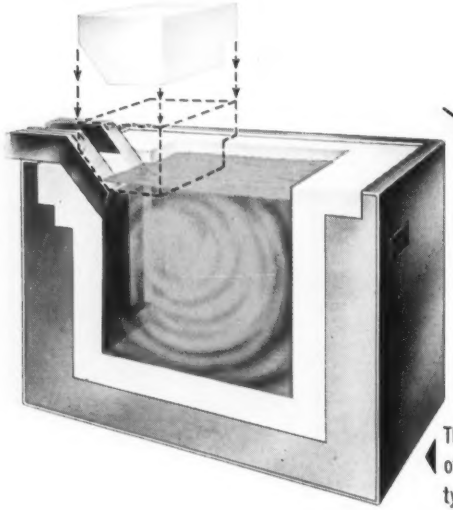
A 4 TO 5 TIME LIFE INCREASE for rock bits resulted from Ajax Salt Bath hardening which also made possible use of plain carbon rather than costly alloy steel. 480 lbs. of work per hour are handled in a bath only 36″ x 11″ x 36″.

SIMULTANEOUS CARBURIZING AND BRAZING of a complicated motor starting assembly are done in one Ajax furnace with one heating of the work as compared to two heatings previously required.

Savings like these are vitally important—and Ajax can help you to realize them to the fullest extent.

The chief product of Ajax is applied heat treating "know how" . . . not merely the largest assortment of salt bath furnace types in the world. When you discuss heat treating matters with Ajax, you get full benefit of unmatched experience not alone in designing and selling furnaces, but in helping you utilize them to best possible advantage.

There is no obligation in having Ajax make a frank appraisal of your heat treating situation.



AJAX ELECTRIC COMPANY
940 Frankford Ave.
Philadelphia 23, Pa.

AJAX
HULTGREN
SALT BATH FURNACES
Internally heated. Electric and gas fired types.

The most efficient heat treating principle for a wide variety of work . . . Pioneered by Ajax in the largest line of furnace types, shapes and sizes for modern production requirements.

PIONEERS IN SALT BATH HEAT TREATING PROGRESS